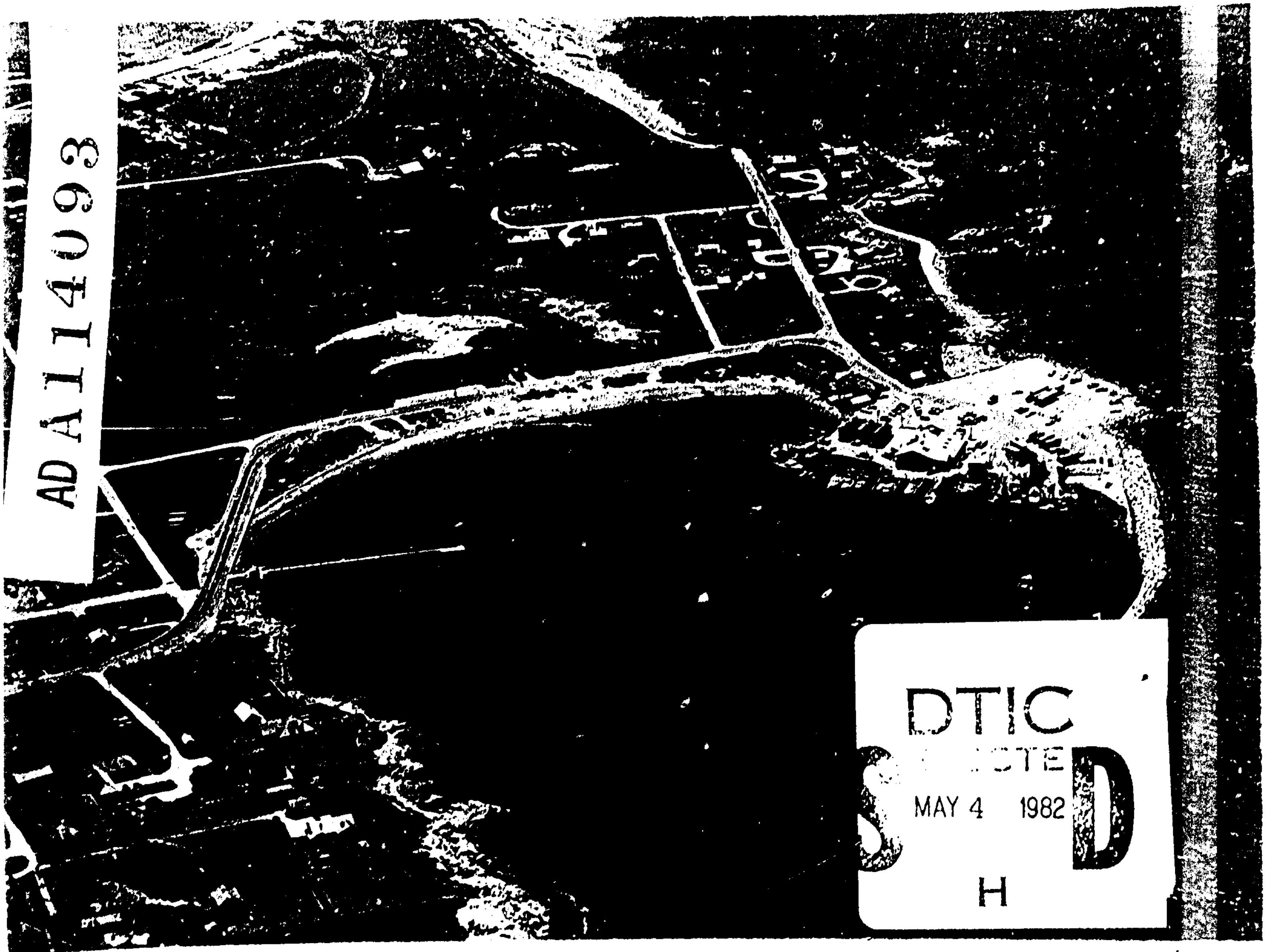
SMALL NAVIGATION PROJECT
SAKONNET HARBOR, LITTLE COMPTON
RHODE ISLAND



DETAILED PROJECT REPORT

DEPARTMENT OF THE ARMY • NEW ENGLAND DIVISION • CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

JANUARY 1981

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The purpose of this study was to determine the cost and economic feasibility of providing navigation improvements in Sakonnet Harbor, Rhode Island, in the interest of commercial navigation and related purposes. Several alternative plans were analyzed in an attempt to economically justify the optimum plan of improvement; a 500- foot rubble-mound breakwater and a channel, 10 feet deep and 110 feet wide. The Appendices list: Problem Identification; Formulation, Assessment and Evaluation of Detailed Plans; Public Views and Response; Engineering Investigations, Design and Cost Estimate; Economic and Social Analysis.

<u>Syllabus</u>

This study investigated navigation needs in Sakonnet Harbor, Little Compton, Rhode Island, to determine the feasibility of providing navigation improvements for commercial fishing vessels.

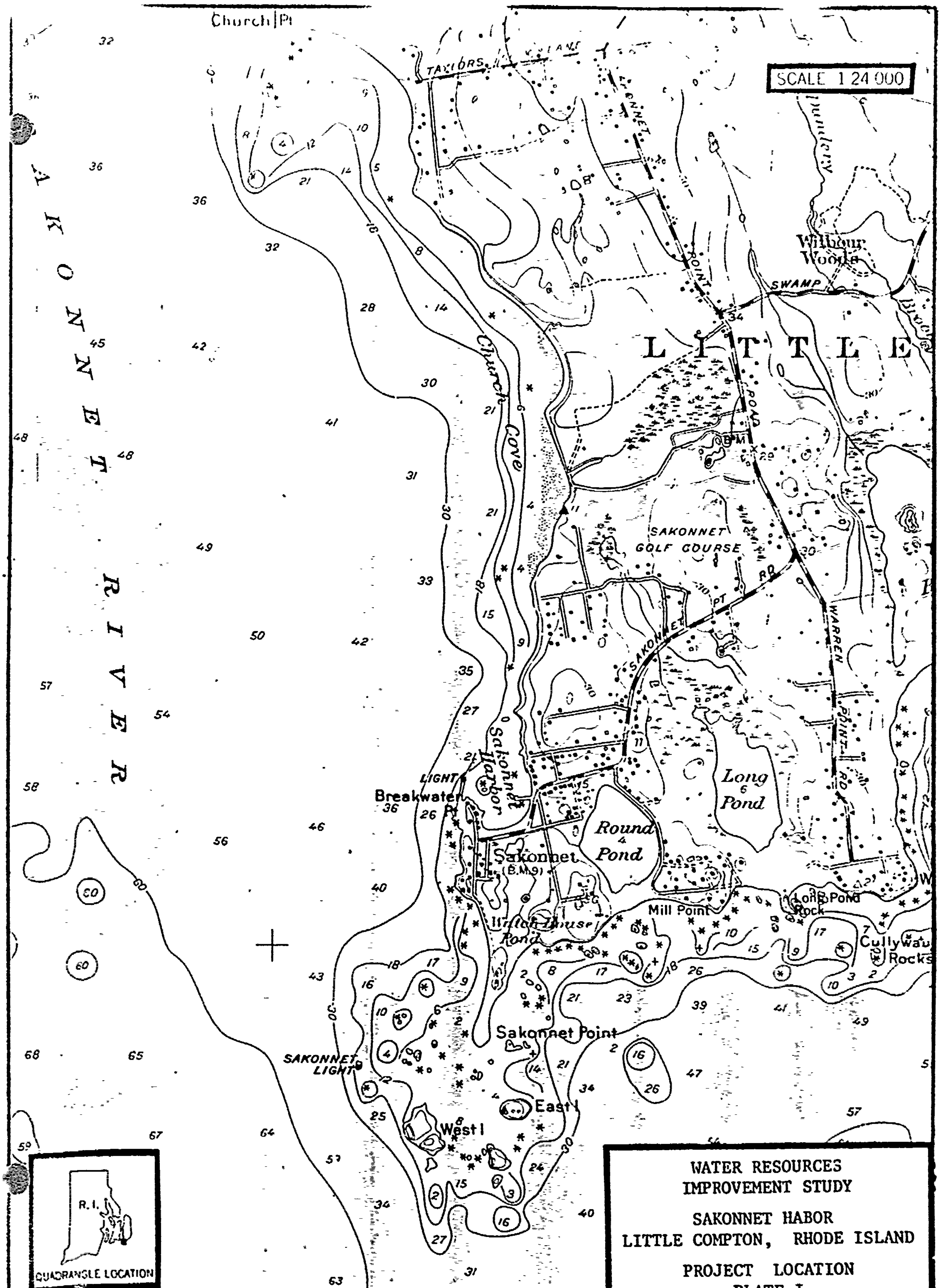
The paramount needs identified are protection of the harbor from waves and ice and reliable and safe access to all facilities in the harbor. The provision of adequate navigation facilities will allow the town of Little Compton to utilize its water resources on a full time, year-round basis.

Several alternatives were analyzed in an attempt to find the optimal improvement plan to meet the present and future needs of commercial fishing activities. The results of this analysis indicate the optimum plan of improvement at this time consists of a 500-foot rubble-mound breakwater and a channel, 10 feet deep and 110 feet wide, from deep water in the Sakonnet River to an area at the head of the harbor where new commercial docking facilities are planned by local interests. The proposed Federal channel would have a total distance of 1,155 feet.

Based on projected waterway use, the selected plan is economically justified. Total cost would be $1,800,000. Annual charges of $154,000 when compared to annual project benefits of $249,100 yield a benefit-cost ratio of 1.6 to 1. Due to the commercial nature of the project, the cost would be borne totally by the Federal government.

It is expected that maintenance of the breakwater and channel will be required every 10 years. Maintenance of the project will be a Federal responsibility, contingent upon the availability of maintenance funds, the continuing justification of the project, and the environmental acceptability of required maintenance activities.

The Division Engineer recommends that, subject to the conditions of non-Federal cooperation outlined in this report, the foregoing plan of improvement to Sakonnet Harbor, Little Compton, Rhode Island, be adopted.



WATER RESOURCES
IMPROVEMENT STUDY

SAKONNET HABOR
LITTLE COMPTON, RHODE ISLAND

PROJECT LOCATION
PLATE I

SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

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Rhode Island

DETAILED PROJECT REPORT

INTRODUCTION

The economy of southeastern New England is closely associated with the abundant fishing resources of the Atlantic Ocean. Commercial fisheries have been a prime factor in the growth of the historic and familiar ports of Newport, Galilee, Fall River, and New Bedford; and today supports a substantial economic activity at these regional centers. Moreover, many smaller coastal communities which possess good harbors also engage in commercial fisheries. When the economic impact of these smaller ports is added to that of the regional ports, it is clear that commercial fisheries represents a very substantial segment of the total economy of southeastern New England.

Sakonnet Harbor is one of those smaller ports in the State of Rhode Island that capitalizes on its proximity to the prime offshore fishing grounds of the Atlantic Ocean. Sakonnet Harbor is in an excellent position to realize additional economic benefits from the commercial fishing industry caused by the increases in foreign and domestic markets, and the protection afforded by the 200-mile limit of United States territorial waters. However, local interests have identified certain improvements that they feel must be provided if these benefits are to be fully and effectively realized at Sakonnet Harbor. The feasibility of Federal involvement in providing these improvements is the subject of this detailed project report.

PURPOSE AND AUTHORITY

This detailed engineering and economic study, which responds to the request of the town of Little Compton, Rhode Island, was made to determine the cost and economic feasibility of constructing a breakwater across the northerly approach to Sakonnet Harbor and deepening the major

commercial navigation channel. The breakwater improvement has been requested in order to reduce wave heights and ice floes produced by northerly and northwesterly winds which cause storm damage to commercial and recreational craft alike, effectively restricting the boating season to summer months. The channel deepening improvement would allow large multipurpose offshore boats to use Sakonnet Harbor as a home port for operations throughout the year.

Senate and House Resolutions of May and September 1976, respectively, and instructions from the Chief of Engineers on 20 May 1976 initially provided authority for conducting a study for providing improvements at Sakonnet Harbor. A Reconnaissance Report was undertaken as the first step in a general investigation into navigation improvements under this authority. After preliminary investigations indicated that the proposed improvements would likely cost less than $2 million it was decided to proceed with the investigation under the authority and provisions of Section 107 of the 1960 River and Harbor Act, Public Law Number 86-645, as amended.

SCOPE OF STUDY

The scope of this study includes performance of a Comprehensive Water Resources Improvement Study and preparation of a Detailed Project Report consisting of:

1. Determining the navigational problems and needs of the study area.

2. Developing alternative improvement plans.

3. Evaluating the economic, engineering, environmental, and social impacts of the alternative plans.

4. Recommending improvements that are economically and engineeringly feasible, environmentally acceptable and socially beneficial.

The geographical scope of this study is generally limited to Sakonnet Harbor. In those instances where project impacts extend beyond the study area, these impacts have been generally identified and evaluated.

STUDY PARTICIPANTS AND COORDINATION

The preparation of this Detailed Project Report required the close cooperation of the Corps of Engineers, other Federal agencies, the Little Compton Town Council, elected officials of State and local governments, the Little Compton Harbor Advisory Board, local commercial fishermen, businesses, associations, and interested individuals. Coordination began in 1975 as the Harbor Advisory Board began to explore the possibilities of obtaining assistance with which to provide needed improvements at Sakonnet Harbor.

The needs for navigation improvements at Sakonnet Harbor were outlined in a report of the Harbor Advisory Board dated 31 January 1976. Subsequently, a favorable congressional response was received, and on 20 May 1976 the Chief of Engineers directed the New England Division to proceed with the study under the authority of Section 107 of the 1960 River and Harbor Act, as it was determined that the proposed improvements being investigated would meet the necessary criteria for the above stated authority. Local public hearings were conducted by the Harbor Advisory Board in July of 1976, and on 15 September 1977 an engineering consultant was retained by the New England Division to perform the study. Close cooperation between the consultant and the Harbor Advisory Board was maintained throughout the period during which this study was conducted.

THE REPORT

This report is a Detailed Project Report, the contents of which are organized in a main report and supporting technical appendices. The main report consists of five main sections, and is organized as follows: Problem Identification, Formulation of Preliminary Plans, Assessment and Evaluation of Detailed Plans, Comparison of Detailed Plans, and an Environmental Assessment.

The report has five appendices which supports the general data provided in the main report: Appendix 1, Problem Identification, augments the data presented in the first two sections of the main report. Appendix 2 addresses the formulation, assessment, and evaluation of detailed plans. Appendix 3 presents public views and responses. Appendix 4 contains the engineering investigations, design, and project cost estimates. Appendix 5, assesses the economic resources of the study area.

PRIOR STUDIES AND REPORTS

A number of previous reports on Sakonnet Harbor, discussed in Appendix 1, have been prepared by the Corps of Engineers. These reports have resulted in approved Federal projects that have provided for the 800-foot long rubble-mound breakwater across the westerly approach to the harbor and the existing 12-acre anchorage, which is dredged to a minimum depth of 8 feet mean low water.

PROBLEM IDENTIFICATION

This portion of the report sets forth the nature and scope of the problems necessitating navigation improvements and establishes the planning objectives and constraints which give direction to subsequent planning tasks.

NATIONAL OBJECTIVES

Planning for navigational improvements in Sakonnet Harbor is based on the national objectives of National Economic Development (NED) and Environmmental Quality (EQ) as set forth in 1973 by the National Water Resources Council in Principles and Standards for Planning Water and Related Land Resources. The purpose of the Principles and Standards is to promote the quality of life by planning for the attainment of the following national objectives:

National Economic Development (NED) Objective -

To enhance national economic development by increasing the value of the nation's output of goods and services and by improving national economic efficiency.

Environmental Quality (EQ) Objective -

To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of certain natural resources, cultural resources, and ecological systems.

EXISTING CONDITIONS

Sakonnet Harbor shown on Plate I is located on the east side of the entrance to the Sakonnet River about 0.4 miles north of Sakonnet Point in the town of Little Compton, Rhode Island. It is approximately 900 feet wide, 1,200 feet long, and 2 to 20 feet deep with an average depth of 8

feet. The harbor has capitalized on its strategic location between Newport, Rhode Island and New Bedford, Massachusetts; and its proximity to the prime offshore fishing grounds of the Atlantic Ocean.

At the present time, the harbor is partially protected on the northwest by an 800-foot Federal breakwater but is totally exposed on the north to waves and ice generated in the Sakonnet River (a description of previous reports and recommendations is located in Appendix 1). As a result, waves that develop far up the river enter unobstructed into the anchorage during the winter season. This lack of protection to the north effectively limits wintertime commercial operations, discourages investment in new and modern equipment, and allows storm damages to recreational and commercial vessels.

The shallowness of the port discourages fishermen from purch[illegible] vessels thereby limiting its commercial development. Current [illegible] the fishing industry favor the employment of vessels 65-feet and l[illegible]ger equipped to change gear that is conducive to alternative fishing modes, when conditions dictate. The addition of boats of this type would substantially increase Sakonnet Harbor's total landings, particularly finfish during the winter months.

Much of the seasonal economic activity in Little Compton is centered around the harbor which is presently utilized by a small locally based fishing fleet that operates principally in seasons of fair weather. Several multipurpose fishing boats, as well as commercial longline fishing vessels operate out of the harbor year-round, but their use from November to March is severely limited. If fishing boats return to the port under adverse conditions, they usually move up the Sakonnet River to more sheltered locations to unload their catch. Marine commerce now located at Sakonnet Harbor includes trap and gillnet fishing, lobstering (inshore and offshore), swordfishing, and shellfishing. There are four commercial fishing companies presently at the harbor which provide private dockage for commecial craft. Approximately forty-five commercial fishing vessels list Sakonnet Harbor as their home port, and another sixteen transient commercial vessels regularly call at the anchorage. One hundred eighteen recreational boats use the harbor as home port, and an estimated 760 transient boats spend an average of one day in port each year.

Sakonnet Harbor currently provides 140 moorings and 25 slips for private users. An additional 30 small sailboats are stored on shore because of the lack of mooring spaces and safe mooring conditions. This total of about 195 craft is supplemented by about 50 skiffs, rowboats, and small outboard motor boats. There are two launching ramps located at the harbor and a daily seasonal average of about 15 motor launches and outboards use these ramps. There has been little change since 1969 in the number of transient recreational craft using the harbor because it is always filled to capacity and there are no new moorings or slips available. Of the private recreational craft in Sakonnet Harbor, there are approximately 56 power and sail vessels over 20 feet in length,

ranging in draft from 1.0 to 5.5 feet. These private recreational vessels have a total value of $524,000. The remaining boats of the recreational fleet are from 12 to 20 feet in length and have drafts between 1.0 and 3.0 feet, and are valued at approximately $128,600.

Only commercial fishing rivals recreational boating in significance to the area's economy during the summer months. Sakonnet fishermen primarily fish for lobster, with 33 of the 45 commercial boats geared for lobstering. The remaining vessels are a mix of power swordfish, trap, seaweed, or charter vessels. Several of the lobster boats are easily rigged for gillnetting and trap fishing when seasonal and cyclical changes in fish population make those types more profitable. These vessels average approximately 33 feet in length and 3.5 feet in loaded draft. Boats with draft up to 7 feet are able to negotiate the harbor's channel, but only under certain tidal conditions and with a high degree of risk involved.

The annual landings exclusive of line and sports fishing were estimated during the 1967-1968 period to be about 5,240,000 pounds of fish and 230,000 pounds of lobsters. No official records were kept at that time for Sakonnet Harbor, and these estimates were prepared by local officials. Since that time, records have been maintained by the National Marine Fisheries Service of the U.S. Department of Commerce.

In recent years, a substantial decrease in catch has been realized in comparison with the reported catch levels of 1967-1968. This decline was the result of a combination of factors, but was due primarily to the severe depletion of fish populations by efficient and modernized foreign trawlers equipped with deep water gear. While the volume of total catch has remained relatively stable since 1971, the steadily increasing unit price resulting from an increased demand for high protein foods, increased cost of meat products, and the scarcity of food staples abroad has prevented a decrease in the commercial value of the landed catch.

Also contributing to the decline in total landings at Sakonnet Harbor has been the elimination of ocean quahogging, due to depletion, from Sakonnet since 1971. During the period from 1969 to 1971, quahog landings averaged about 46,000 bushels or 460,000 pounds of meat per year. The unavailability of these resources at Sakonnet Harbor acquired added significance due to the dramatic increase in demand for ocean quahogs by seafood processors in Rhode Island and other neighboring states. However, the availability of surf clams in waters with close proximity to Sakonnet Point has somewhat offset the economic loss associated with the decline in quahogging. Landings of surf clams totaled over two million pounds (shell stock weight) valued at $188,780 in 1978. Local fishermen have expressed their belief that at the time this supply is exhausted, the quahog resource will be somewhat replenished.

CONDITIONS IF NO FEDERAL ACTION TAKEN

Without the implementation of improvements at Sakonnet Harbor to provide protection of the vessels anchored there, little change in the status quo can be expected. The size of the commercial fishing fleet has remained static over the last 10 years, due to limits on expansion space and exposure to the elements. There is little doubt that this condition will continue given the present limited facilities and despite the general trends toward improved opportunities in ocean fisheries. Over the long run, it is likely that the condition of the fishing industry in Little Compton will deteriorate due to an inability to compete with more efficient operations out of neighboring ports.

The larger, well-established fishing ports at Newport and Galilee presently land about 95 percent of the state's total catch, and these ports should continue to dominate future fishing commerce in Rhode Island. However, probable expansion of the fishing industry due to replenishment of the resource under the 200-mile limit on territorial waters should allow small harbors to prosper from increased catches as well. This possibility would be precluded at Sakonnet Harbor if none of the considered improvement schemes were adopted. The harbor will continue to remain almost useless during the period 1 November to 15 February.

Because conditions at Sakonnet Harbor presently discourage the modernization of the fishing fleet to include the more efficient and productive trawlers capable of gillnetting and longlining on a year-round basis, landings at that port cannot be expected to increase significantly in the absence of physical improvements. Only the 12 boats currently anchored at Sakonnet with the capability of operating on a year-round basis would be expected to continue doing so in the future. Similarly, lobstering would continue on a scale approximately equivalent to that which exists today. The trend toward offshore lobstering would continue, with Sakonnet's lobstermen either operating out of alternative ports during winter months or hauling their vessel ashore until spring.

PROBLEMS, NEEDS AND OPPORTUNITIES

Sakonnet Harbor's exposure and extreme southerly location have made it susceptible over the years to damage by northerly winds, waves and ice. This exposure has prevented any substantive expansion of harbor facilities. The harbor, therefore, historically has served only a limited role in the area's economy. The future of the harbor clearly depends on implementation of improvements to provide protection from extreme weather conditions and the dominant winds which enter from the north. Increased markets for New England lobster and ocean quahogs provide an opportunity for Sakonnet Harbor to assume a more significant role in the regional economy if the desired protection is provided.

The most important and significant improvement required at Sakonnet Harbor is the provision of a year-round navigation system. With this

improvement, Sakonnet Harbor faces a promising future in the expanding commercial fishing industry.

The economic benefits resulting from the provision of a year-round harbor accrue to the commercial fishing fleet. Within a short period of time the commercial operators will be encouraged to modernize and upgrade their gear and equipment, and some will even purchase new boats. Also within a few years, new and larger offshore boats could be added to the existing fleet, thereby producing significant economic benefits to the commercial fleet.

Reflecting the needs described above, the Little Compton Town Council and its Harbor Advisory Board have requested the following improvements for Sakonnet Harbor.

- A breakwater to protect the harbor from heavy seas and floating ice generated by north and northwest winds.

- An access channel of sufficient dimensions to serve the anticipated addition of new multipurpose fishing vessels.

PLANNING CONSTRAINTS

Planning constraints are those parameters which can place limitations on any proposed plan of improvement. As limitations, they are used to direct plan formulation and restrict impacts cutting across a broad spectrum of concerns. These concerns may include natural conditions within the project site, technological states of the art, economic limits, and legal restrictions.

Through consultation with government agencies and local interests, this study has identified one issue which may be identified as a planning constraint.

The town of Little Compton, being predominantly residential, does not have a road network which would be capable of accommodating large numbers of heavy construction equipment. The area in which the proposed breakwater would be constructed can be reached by a one-lane tertiary road bordered on both sides by private property. Therefore, existing conditions require that breakwater construction be entirely offshore.

In summary, the only planning constraint identified is:

. Limit breakwater construction to offshore activities.

PLANNING OBJECTIVES

Planning objectives for this study were established after carefully analyzing the identified concerns regarding the use of water and related land resources in this study area. The purpose of these planning objectives is to translate identified needs, opportunities, and problems into specific objectives for the study. Planning objectives, as set forth herein, will be used in conjunction with planning constraints in the development of alternate plans that properly address study objectives and area needs. The establishment of clearly defined planning objectives is also essential in evaluating the various plans that have been studied. The relative merit of each plan is determined, in great part, by the degree to which it addresses and fulfills each planning objective.

Based on the discussions of problems, needs and opportunities previously presented, two planning objectives have been identified as important guidelines to formulation and evaluation of plans to meet the area needs and study objectives.

- Contribute to commercial navigation in Sakonnet Harbor during the 1980-2030 period of analysis.

- Contribute to the year-round utilization of Sakonnet Harbor for commercial vessels during the 1980-2030 period of analysis.

FORMULATION OF PRELIMINARY PLANS

Systematic consideration of the problems, needs, and opportunities led to the formulation of alternative preliminary plans. These plans, designed to acheive the planning objectives stated previously, were developed in light of the planning constraints. State and local objectives were also paramount considerations in the evaluation of alternative plans.

MANAGEMENT MEASURES

As the basis for formulating alternative plans, a broad range of management measures can be identified to address one or more of the planning objectives. Management measures can generally be categorized as either structural or nonstructural.

Structural measures would generally involve construction of a navigation system which would permit year-round utilization of the harbor and attendant facilities. Nonstructural measures would principally involve the transference of fishing activities to another harbor which has adequate protection and capacity under existing conditions.

Due to the constraints and objectives placed on the project, there are no feasible means to accomplish the project objectives by implementation of non-structural solutions.

The primary non-structural solution for the Sakonnet Harbor fishing fleet is to transfer existing and potential commercial operations to other nearby ports. In relatively close proximity to Sakonnet Harbor are the ports of Newport and Galilee on the west and New Bedford and Westport on the east. Newport has recently been the subject of a Federal navigation improvement study, but no work has been completed due to environmental constraints. A Federal navigation improvement was completed in Galilee in 1976 to allow for further development of the commercial fishing industry. Presently no additional capacity exists in Galilee for further expansion.

Further development of the ports of Westport and New Bedford has been limited by both economic and environmental constraints, and the possibility for further development of these harbors is remote at best. Therefore, as an alternative to structural protection of Sakonnet Harbor, transferring of existing facilities has been eliminated from further consideration because no capacity now exists in nearby ports and none can be anticipated in the near future. Further data on non-structural solutions is provided in Appendix 2.

Based on the above considerations, it was decided to analyze structural solutions to solve the present problems in Sakonnet Harbor.

PLAN FORMULATION RATIONALE

The formulation of plans of improvement for Sakonnet Harbor are predicated on a standard set of criteria adopted to permit the development and selection of a plan which responds to the problems and needs of the area. Each alternative was considered on the basis of its contribution to the planning objectives.

Selection of a specific plan for Sakonnet Harbor is based on technical, economic, and environmental criteria which would permit a fair and objective appraisal of the consequences and feasibility of alternative solutions.

Technical criteria requires that the optimum plan should have facilities and dimensions adequate to accommodate expected user vessels and have sufficient areas both for the maneuvering of boats and the development of shore facilities.

Economic criteria specify that tangible benefits should exceed economic costs and that the scope of the project is such as to provide maximum net benefits.

Environmental criteria involve utilizing available sources of expertise to identify endangered species of marine life. Furthermore, the use of natural resources to affect plan utilization as well as adverse social impacts should be minimized. Environmental criteria require that activities attracted to the area after plan implementation should be consistent with activities of the surrounding area, and that said activities be environmentally acceptable. The selected plan should incorporate measures to preserve and protect the environmental quality of the project area. Finally, both plan formulation and implementation should be coordinated with interested Federal and non-Federal agencies, local groups, and individuals through cooperative efforts, conferences, public meetings, and other procedures.

ANALYSIS OF PLANS CONSIDERED IN PRELIMINARY PLANNING

During the early stages of this study, various breakwaters differing in alignment, size, location, and type were analyzed. Therefore, preliminary planning generally involved an attempt to identify the most practical breakwater types, dimensions and alignments to be considered in detail.

The various breakwater alignments investigated, shown on Plate II, include the following:

Alternative A - A 750-foot rubble-mound breakwater approximately 100 feet offshore from a plot of land numbered 36, as shown on the Little Compton plot plan. This alternative would allow for protection of the harbor from wind generated waves and ice flows during the winter season. It would also provide a high degree of protection to the recreational craft located in the northeastern section of the harbor.

Alternative B - A shortened 500-foot rubble-mound breakwater located as in Alternative A but approximately 450 feet offshore. This structure is expected to provide a comparable amount of protection to the fishing fleet but would leave the recreational craft moored in the northeast

anchorage areas exposed to the occasional summer storm from the northerly quadrant.

Alternative C - A 600-foot rubble-mound breakwater beginning at the southwesterly terminus of the Alternative B breakwater. This structure would not provide a comparable amount of protection as the other two alternatives.

Alternative D - A 950-foot rubble-mound structure connected to shore to provide full protection to the commercial facilities and the easterly side of the harbor against heavy seas.

Alternative E - A floating breakwater, capable of being reoriented for protection against predominant seasonal winds and waves. Variances in this alterantive would alllow for differing lengths to be analyzed.

Alternative F - A steel sheet pile breakwater following the same alignments as either Alternative A, B, C or D.

The location of the existing and proposed on-shore support facilities would dictate the general alignment of the channel. However, development of the appropriate width and depth required further analysis.

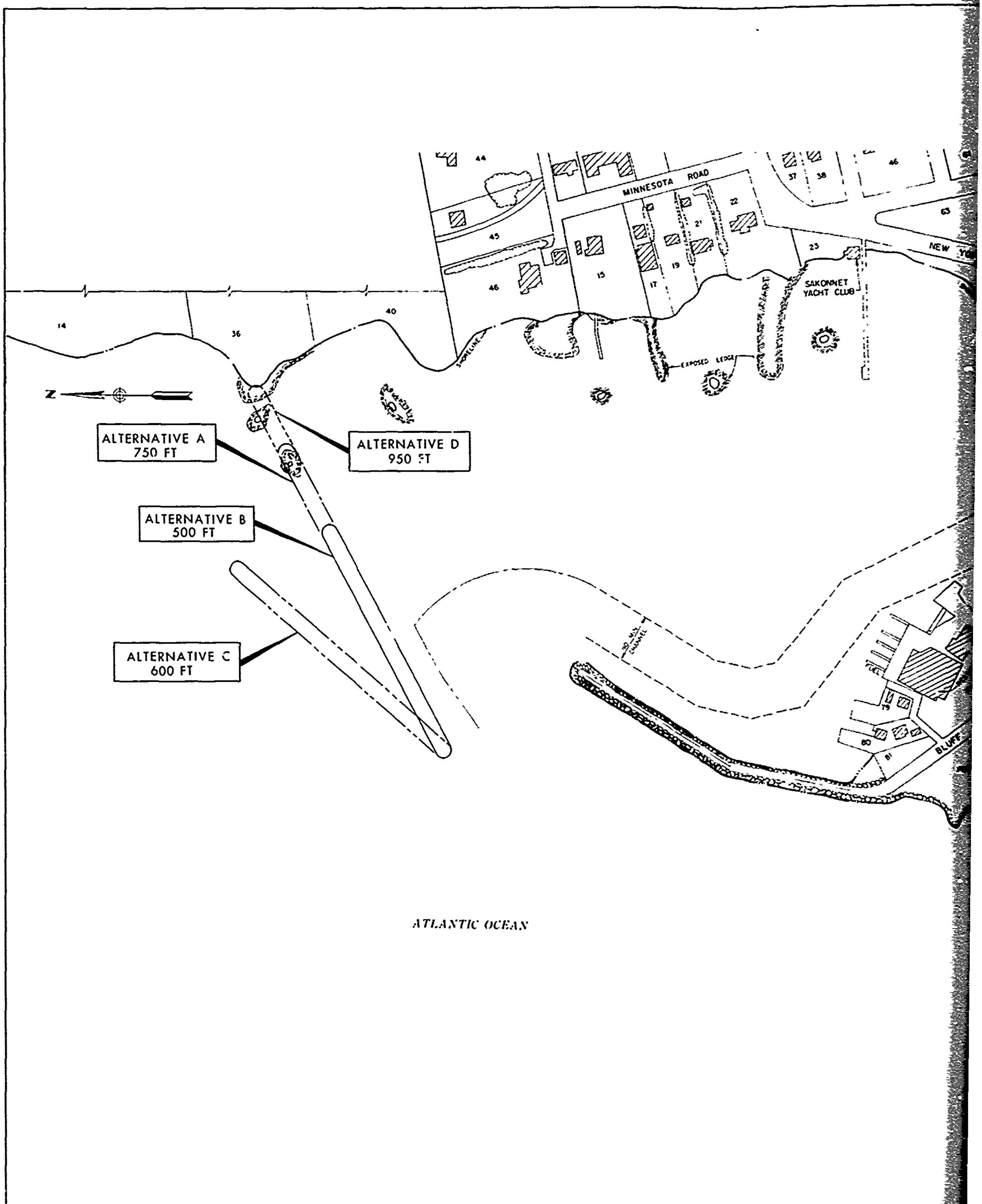
Local interests have indicated a desire to make Sakonnet Harbor capable of supporting 65-foot multi-purpose fishing boats. Analyses have indicated that such utilization can be made practicable if uninterrupted navigation can be provided for this class of vessel. Drawing from 7 to 8 feet loaded, a minimum depth of 10 feet would be required to allow these vessels to navigate within the harbor at all stages of the tide with safe bottom clearances.

The width of this class of vessel varies considerably, but it is generally agreed that beams can range from 15 to 25 feet. For purposes of this report, a design beam of 22 feet has been chosen thereby indicating that a channel width of 110 feet would be necessary to allow for two-way traffic. The design of a 110-foot channel will permit safe transit of two vessels passing one another with the design vessel width to 22 feet between the two craft and the channel boundary.

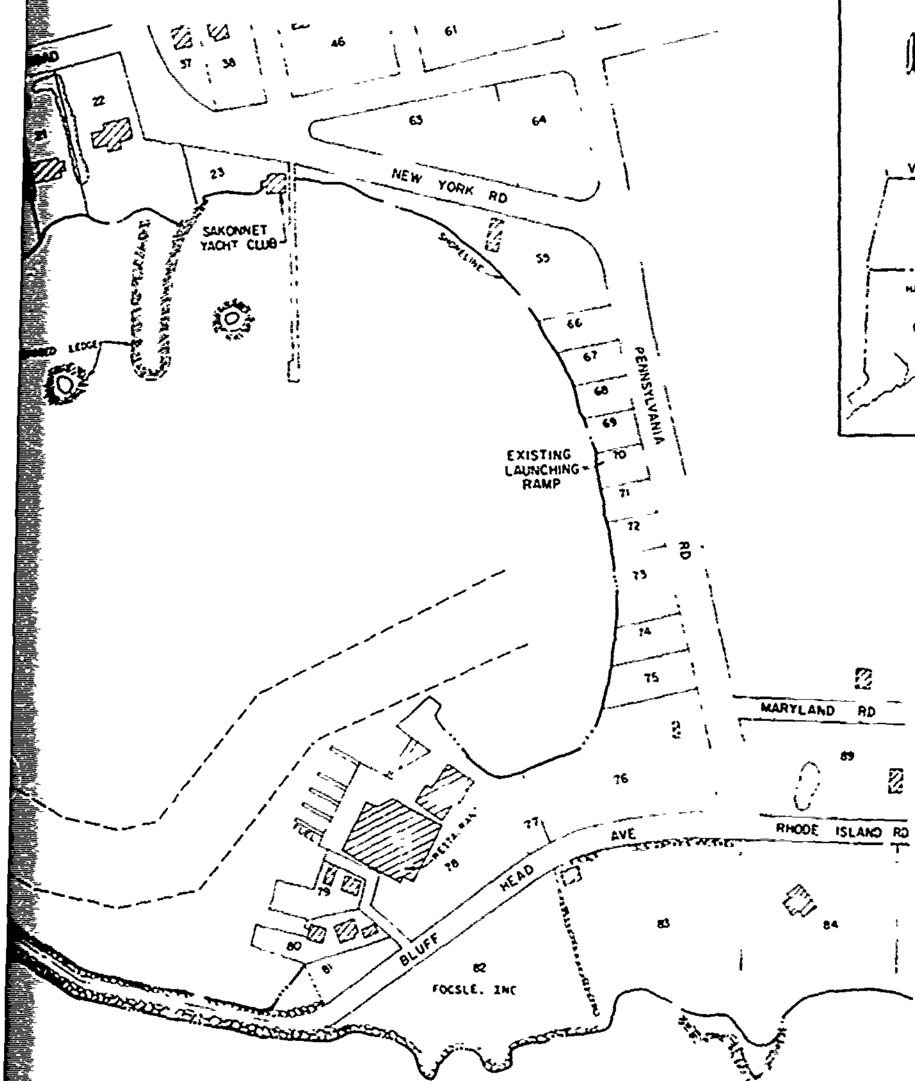
In summary, the proposed channel would be 10 feet deep at mlw with a width of 110 feet for a total length of 1,155 feet culminating at the head of the harbor adjacent to the proposed commercial facility improvement. Channel dimensions and design computations are discussed in detail in Appendix 5.

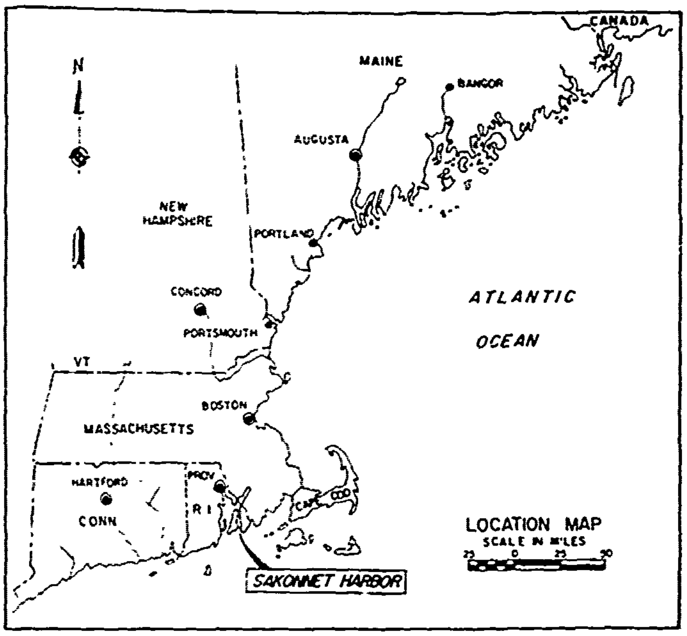
COMPARATIVE ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS

An evaluation of the alternatives considered indicate that not all conform to the planning objectives and constraints.



ALTERNATIVE A
750 FT
ALTERNATIVE D
950 FT
ALTERNATIVE B
500 FT
ALTERNATIVE C
600 FT
MINNESOTA ROAD
SAKONNET
YACHT CLUB
EXPOSED LEDGE
NEW YO
BLUFF
ATLANTIC OCEAN





DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MA.

SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

ALTERNATIVE PLANS

DATE SEPTEMBER 1980 SCALE 1"=100'

Alternative A, would provide the maximum amount of protection to the harbor from waves and ice of all the alternatives with the exception of Alternative D. The distinction between alternatives A and D is that Alternative A would allow for more tidal flushing of the harbor.

Alternative B, although not capable of providing the maximum protection to the harbor, would nevertheless permit the commercial fleet to operate during the winter season and would allow for flushing of the harbor.

Alternative C, by virtue of its orientation may not provide complete protection to the harbor, but, it would allow for more efficient tidal flushing of the harbor than any other alternative which involves a rubble-mound structure.

Alternative D, does not achieve the stated planning objectives [illegible] not conform to the Little Compton harbor use plans. Local int[illegible] indicated a desire to maintain an opening on the shoreward side of [illegible] proposed structure for purposes of tidal flushing and aesthetics. [illegible] addition, this structure would provide protection to a portion of the harbor that is not utilized during the winter season. Finally, by completely closing the northeast side of the harbor, tidal currents would be significantly impacted, and tidal circulation and harbor flushing would be impeded resulting in a neg tive impact in the harbor.

Alternative E, does not achieve the planning objective of providing a safe year-round anchorage. This structure would provide little protection against ice flows formed upstream in the Sakonnet River, as the ice could cause severe damage as the ice accretes along the length of the structure. As the weight of the ice becomes substantial, the structure could break up or sink. In a damaged condition, the harbor would be virtually unprotected against waves until the structure could be repaired. Also, floating breakwaters are most effective against a short choppy wave not long period waves of the type anticipated to be predominant in this application.

Alternative F, would require a greater expenditure of funds to accomplish the planning objectives while generating no additional benefits. Secondly, a steel sheet pile breakwater would have potentially more negative impacts on wave refraction and reflection than on an energy absorbing rubble-mound structure. Also, a comparative analysis with a rubble-mound structure has historically shown that lower maintenance and greater performance can be expected with the rubble-mound structure. Finally, it is most likely that steel sheet piles could not be driven to a stable elevation due to the height of bedrock in the harbor.

CONCLUSIONS

Based upon an evaluation of the degree to which each alternative attained the planning objectives and worked within the planning constraints, Alternatives A, B and C have been selected for further evaluation. The following sections of this report will assess and evaluate in detail the selected alternatives, hereafter referred to as Plans A, B, and C.

ASSESSMENT AND EVALUATION OF DETAILED PLANS

The preliminary screening of alternatives has resulted in the conclusion that a rubble mound breakwater is the most efficient structure available to adequately protect Sakonnet Harbor from northerly winds and allow year-round use of the harbor by commercial fisherman. Additionally, limited dredging is required in the existing navigation channel (part of the present anchorage) to allow the commercial fishermen at Sakonnet to bring in larger multipurpose fishing vessels. Although there is no official designation of the channel, approximately 80 feet in width is utilized to permit free and unobstructed passage to the shore based facilities. The ecomomic analyses which were used to determine the optimal width and depth of the access channel is located in Appendix 5. Since the channel dimensions chosen are considered minimal for expected use they will be the same for all detailed plans.

The three detailed plans described in the following sections are basically variations of the rubble mound breakwater alternatives. These variations involve differences in length and alignment. Impacts exist which are common to all three plans and they will be discussed in the following sections. Impacts which are unique to each plan are assessed and evaluated in subsequent sections of this report.

GENERAL ASSESSMENT AND EVALUATION OF IMPACTS

All three breakwater plans will provide a high degree of protection to the commercial fishing fleet and facilities, both existing and proposed, from waves generated by northerly winds during wintertime storms. On 29 July 1980, members of the Corps of Engineers, Cold Regions Research and

Engineering Laboratory visited Sakonnet Harbor to determine the existing ice problem and evaluate the impacts any structure would have on ice and ice-related problems. It was determined that the breakwater will not reduce the buildup of ice in Sakonnet Harbor during extremely cold winter periods. Ice driven by a northwest wind will enter the harbor through the gaps at the northeast end of the proposed breakwaters and mush ice will form within the harbor. The structures will not reduce the the amount of ice entering the harbor, but the reduced wave action should lessen the pushing and thickness of the ice at the beach end of the harbor making it easier to break out by the fishing boats. However, due to less wave action mush ice freezing together may increase.

A detailed hydrographic computer model of Sakonnet Harbor, located [illegible] Appendix 4, and discussed in the environmental assessment, [illegible] that any breakwater structure will have some impact on tidal currents within the harbor. The flushing of Sakonnet harbor resulting in an [illegible] water between the harbor and the Sakonnet River, accounts in part [illegible] good degree of water quality within the harbor. At present, the rate of flushing within the harbor is largely controlled by wind generated currents. Tidal generated currents account for only up to 10 percent of the total flushing action. Construction of any breakwater would reduce tidal effects but would not significantly impact on wind generated currents. A decrease in flushing rates on an order of roughly five percent could be expected regardless of the breakwater's length or orientation. Different designs will, however, significantly effect selected areas within the harbor. Generally, the shorter the breakwater, the lesser its impact upon flushing and water quality. These effects are more fully discussed in Appendix 4.

Other impacts associated with breakwater construction and channel dredging are those short-term impacts usually associated with heavy construction. No unusual problems in this regard are anticipated. The impacts associated with the limited dredging of a ten-foot channel should be minimal since the material to be dredged is clean sand and rock and will be deposited on land, south of Bluff Head Avenue as shown on Figure 4-9.

Long term impacts of dredging include removal of existing benthic organisms from the harbor bottom and removal or alteration of marine habitats.

None of the three plans will significantly impact the Sakonnet Harbor shoreline. Using a breakwater that is not connected to shore was considered a basic requirement in plan formulation to allow for better flushing action within the harbor.

Provisions of a breakwater and designation of a channel to the shorefront facilities in Sakonnet Harbor will impact both the recreational and commercial users of the harbor.

The commercial fishermen of Sakonnet Harbor will be allowed to upgrade their vessels and bring in new multipurpose fishing vessels at all tidal stages the year-round. As the harbor becomes more heavily utilized by commercial fishing boats. the channel will minimize any potential collisions with recreational boaters during the summer months and contribute to the overall operating efficiency of the harbor.

There will be a small amount of area in the south and southwest portion of the harbor currently used to anchor vessels that will be lost for anchorage purposes. Vessels will not be allowed to moor in the 110-foot Federal access channel after project construction. Currently, local interests have been historically utilizing an entrance channel to commercial facilities that is approximately 80 feet wide in which vessels do not currently moor. The anticipated net loss, therefore, in mooring space currently available in the harbor is 30 feet for the length of the channel in its improved condition. This loss totals less than 1 2 acre. This loss will most likely be mitigated by mooring in naturally deep areas in the northern portion of the harbor, where boats currently moor during various portions of the boating season. While this area will be protected against the occasional northerly storm in the summer, it should be noted that refraction/defraction computations indicate that waves generated by storms from the southwest will be amplified slightly by the configuration of any new breakwater. Hindcast wave analyses indicate that this portion of the harbor currently experiences waves of 9 feet and that any breakwater structure may increase this height to 10.5 feet. During these periods of southwesterly storms, vessels would have to be moved to avoid damage, but no more so than that which currently takes place with a 9-foot wave. So the small loss in mooring space should be identified by local interests and some adjustments should be made in local mooring management plans in light of the engineering data presented in this report.

All of the plans considered in detail will result in both social and economic impacts to the town of Little Compton and to the region as a whole. These impacts are more fully discussed in Appendices 1 and 5, respectively.

Social impacts resulting from the harbor improvement would include reduced unemployment as a positive impact. Some adverse impacts might result from increased truck traffic to the harbor although this should be minimal, as the increase will occur principally in the winter.

There should be little, if any, impact to the summer residents of Little Compton and the recreational users of Sakonnet Harbor because the major portion of the increased commercial activity will occur during the fall and winter months when summer users are not in residence.

The economic impacts associated with improvement of the harbor include: the primary benefit of increased income to local fishermen; and secondary benefits including increased tax revenue to Federal, State and local governments; and reduced contributions from these governments in

unemployment and welfare payments through increased employment opportunities.

MITIGATION REQUIREMENTS

In order to reduce potential impacts of the proposed improvement construction timing would be of the utmost importance. Breakwater construction will take place entirely offshore using barge-mounted cranes and stone-carrying scows. Although this will minimize on-shore vehicular traffic, some inconvenience to recreational boaters will undoubtedly result. Consequently, construction should begin soon after the recreational boating season ends. Since breakwater construction should require no more than one year, only one boating season would [illegible] be affected.

Dredging of the navigation channel would require approximately [illegible] to complete. It should be scheduled for completion during the fall or winter in order to minimize conflicts with recreational boaters and to avoid any adverse environmental damage that could result, if the dredging were done during the more productive spring and summer seasons.

IMPLEMENTATION RESPONSIBILITIES

The implementation responsibilities for all three detailed plans are not significantly different. Consequently, all costs associated with the initial project construction except for the costs for containment structures at the dredged material disposal site will be a Federal responsibility.

COST ALLOCATION AND APPORTIONMENT

All of the quantifiable benefits that would result from any of the detailed plans of improvement for Sakonnet Harbor would accrue and can be allocated to the existing and projected commercial users of Sakonnet Harbor. Consequently, all costs for construction would become a Federal responsibility.

All of the detailed plans considered involve channel dredging and breakwater construction, and funds for construction will be allocated through the Chief of Engineers, acting under the authority of Section 107 of the 1960 River and Harbor Act.

FEDERAL RESPONSIBILITIES

The Federal Government will assume all costs, within the cost limitation of $2,000,000, for initial construction of this project because of the general, or widespread nature of benefits to commercial navigation except for all costs associated with the containment of the dredged material. In addition the Federal Government will maintain this waterway

improvement to assure continued navigability. All pre-authorization study costs as well as the design, preparation of plans and specifications, and contract administration are Federal responsibilities.

NON-FEDERAL RESPONSIBILITIES

The town of Little Compton, Rhode Island, the local sponsor, would be responsible for the operation and maintenance of an adequate public landing for the sale of fuel, lubricants, and drinking water to all on an equal basis, and for providing all necessary lands, easements, and rights-of-way for construction and subsequent maintenance of the project, including disposal areas for dredged materials.

The town would also hold the United States free from damages that may result from construction and maintenance of the project. Moreover, the local sponsor would provide and maintain berths and other mooring facilities for local and transient vessels as well as access roads, parking lots and other required public use shore facilities, open and available to all on an equal basis.

The local sponsor would assume the responsibility for all project costs in excess of $2,000,000. Finally, the town would establish regulations prohibiting the discharge of untreated sewage and other pollutants into the waters of Sakonnet Harbor.

PLAN EVALUATION

PLAN A

PLAN DESCRIPTIONS

Plan A would provide for a 750-foot rubble mound breakwater on a bearing of south 62° west running from a point approximately 100 feet offshore from a plot of land, numbered 36, as shown on the town of Little Compton plot plan and Plate II. The breakwater would be at an elevation of 8 feet above mean low water. The plan also provides for a 110-foot wide navigation channel along the existing west harbor breakwater to provide

access for the commercial fishing fleet. This channel will be 10 feet deep at mean low water.

IMPACT ASSESSMENT

Breakwater Impacts

The Plan A structure would entail the most significant change in tidal current patterns within the harbor. As it would allow for only a 100-foot clearance between itself and the shoreline, the movement of water within the harbor would be constricted and also have a greater tendancy to allow for debris and refuse to remain within the harbor. Water quality would be most affected by this plan because it has the greatest impact on tidal currents and therefore entails the greatest reduction in flushing of the harbor.

Impacts on Navigation

Plan A would allow for the utilization of Sakonnet Harbor on a year round basis. As a greater portion of the southeastern end of the harbor would be protected, it would allow for future expansion beyond what is presently contemplated. During the summer season, 2he recreational fleet would be protected from the occasional summer storm out of the north-northwest.

Economic Impacts

Breakwater costs are based on utilizing the Tiverton quarry and dredging costs are based on a nearby land disposal site which had been previously identified.

The estimated first cost of Plan A is $2,482,700. The annual costs, based on an interest rate of 7-3/8 percent is $210,900. The annual project benefit is estimated at $249,100.

Annual cost and benefits are shown below.

Annual Costs	Annual Benefits	B/C Ratio	Net Benefits
$210,900	$249,100	1.2	$16,200

EVALUATION AND TRADEOFF ANALYSIS

Of the three plans considered for detailed evaluation, Plan A provides the maximum amount of protection to the harbor. Therefore, this plan will allow for winter utilization of the harbor by the commercial fishing fleet and will also provide protection to those recreational craft moored in the eastern side of the harbor during the summer season.

However, Plan A would protect a segment of the harbor which is not presently planned for development and has an adverse impact on tidal

current and hence water quality within the harbor. As the structure allows for only a 100-foot clearance, water quality would be degraded to allow for optimal boating safety and utilization.

COST APPORTIONMENT

The local portion of the costs of the Federal project for Plan A are all costs above the Federal cost limitation of $2,000,000 which is currently estimated at $482,700, plus a 100 percent share of related improvements and all necessary diking of the disposal site.

PUBLIC VIEWS

View of Federal Agencies - Pending review of the Draft Detailed Project Report.

View of Non-Federal Agencies and Ohters - Pending review of the Draft Detailed Project Report.

PLAN B

PLAN DESCRIPTION

Plan B would provide for a 500-foot rubble mound breakwater on a bearing of south 62° west running from a point approximately 450 feet offshore from a plot of land, numbered 36, as shown on the town of Little Compton plot plan. The breakwater would be at an elevation of 8 feet above mean low water.

IMPACT ASSESSMENT

Breakwater Impacts

Plan B allows for a 450-foot clearance between the structure and the shoreline. By allowing for current flow around the shoreward side of the breakwater a 50 percent increase in tidal flow along the breakwater and out of the harbor can be expected over that expected in Plan A.

Impacts on Navigation

Plan B would allow for the utilization of Sakonnet Harbor on a year-round basis. The structures would have minimal impact on the present ice problems, and the recreational fleet would be partially exposed to the occasional storm out of the north-northwest.

Economic Impacts

Breakwater costs are based on utilizing the Tiverton quarry and dredging costs are based on a nearby land disposal site.

The estimated first cost of Plan B is $1,800,000. The annual costs based on an interest rate of 7-3/8 percent is $154,000. The annual project benefit is estimated at $249,100.

Annual costs and benefits are shown below:

Annual Costs	Annual Benefits	B/C Ratio	Net Benefits
$154,000	$249,100	1.6	$95,100

EVALUATION AND TRADEOFF ANALYSIS

Plan B provides the optimal amount of protection to the existing and proposed onshore commercial facilities and the commercial fishing boat anchorage. The structure would provide minimal protection for the recreational craft during the occasional summer storm from the north.

Plan B while protecting the harbor would provide for a high degree of tidal flushing action with minimal degradation of water quality.

COST APPORTIONMENT

The local interests would be required to bear all costs in excess of the $2,000,000 limitation. In addition, a 100 percent share of related improvements and all necessary diking of the disposal site would be a local responsibility.

PUBLIC VIEWS

View of Federal Agencies - Pending review of the Draft Detailed Project Report

View of Non-Federal Agencies and Others - Pending review of the Draft Detailed Project Report.

PLAN C

PLAN DESCRIPTION

In addition to the channel of Plans A and B, Plan C includes a 600-foot rubble mound breakwater on an approximate bearing of south 42° west beginning at a point coincident with the southwesterly terminus of the breakwaters proposed in Plans A and B. The proposed Plan C or reoriented breakwater would also be at an elevation of 8 feet above mean low water.

Impact Assessment

Breakwater Impacts

The Plan C structure would entail the least significant impact on tidal currents within the harbor. Reorientation of the breakwater as proposed in Plan C would result in an increase in the degree of flushing of the harbor and result in a reduced impact on water quality. An 85 percent increase in tidal flow over plan A and a 50 percent increase in tidal flow over Plan B can be expected along the breakwater.

Impacts on Navigation

Plan C would provide the least protection to the harbor during the winter months. Ice floes would have the same potential to enter the harbor as that which currently exists and the recreational fleet would be completely exposed to storms out of the north-northwest.

Economic Impacts

Breakwater costs are based on utilizing the Tiverton quarry and dredging costs are based on a nearby land disposal site.

The estimated first cost of Plan C is $2,115,600. The annual costs, based on an interest rate of 7-3/8 percent is $180,000. the annual project benefit is estimated at $165,700.

Annual costs and benefits are shown below:

Annual Costs	Annual Benefits	B/C Ratio	Net Benefits
$180,000	$165,700	1.0	$0

EVALUATION AND TRADEOFF ANALYSIS

Plan C provides the least amount of protection to the existing and proposed onshore commercial facilities and the commercial boat anchorage. The structure would also provide minimal protection for recreational craft.

Plan C with minimal protection of the harbor would provide for optimal tidal flushing and cause the least degradation of water quality.

Cost Apportionment

The local interests would be required to bear all costs in excess of the $2,000,000 limitation. In addition, a 100 percent share of related improvements and all necessary diking of the disposal site would be a local responsibility.

Public Views

View of Federal Agencies - Pending review of the Draft Detailed Project Report

View of Non-Federal Agencies and Others - Pending review of the Draft Detailed Project Report.

COMPARISON OF DETAILED PLANS

In general, in comparing the detailed plans, a trade-off must be made between maximization of protection of the commercial fishing fleet and the risk of disrupting tidal patterns within the harbor and, by implication, flushing action. At the same time a trade-off must be made between the maximization of project and project costs.

The impacts described in earlier sections apply to all three detailed plans. More specifically, the degree with which each alternative impacts the flushing action within the harbor and the protection afforded the shorefront facilities is what differentiates alternatives.

As mentioned earlier, any breakwater structure placed in the general northerly area of Sakonnet Harbor will change tidal current patterns in the harbor. Wind-generated and tidal currents are the driving forces involved in the flushing action of Sakonnet Harbor with wind-generated currents on the average, an order of magnitude greater than tidal currents, that is, about ten times as great.

As discussed in the environmental assessment, and Appendix 4, the Plan C breakwater, as predicted by the computer model, would have the least impact on tidal currents within the harbor. Plan A would have the greatest impact due to the reduced opening at its northeasterly end. Plan B would have more impact than Plan C, but far less than Plan A. However, it should be stressed that the absolute significance of any change in tidal currents brought about by any breakwater is minimal because flushing action within the harbor is dominated by wind-driven currents.

The degree of protection afforded the shorefront facilities from northerly winds for the three detailed plans is basically the same for Plans A and B, and less for Plan C. Also the potential for allowing ice buildup in the harbor is greater for Plan C because the shore to breakwater opening at its northern end is greater. It is almost impossible, however, to predict ice buildup because of the uncertainties involved, including temperature duration and wind direction. Located in Appendix 3 is a summary letter report dealing with the potential of ice formation and its impacts on the harbor.

COST COMPARISON

Table 1 compares the cost of the three plans considered in detail. All three plans involve the same magnitude of channel dredging. However, one can readily see that Plan B, the 500-foot long breakwater on an alignment of S62^{o}W requires the least total construction investment. Plan A, the 750-foot long breakwater on a similar alignment, is the most costly. Plan C, the 600-foot long breakwater rotated 20^{o} further south into relatively deeper water, is over $179,000 more expensive than Plan B.

Table 1 also lists the annual charges associated with each detailed plan. In developing these annual charges, a Federal cost of 7-3/8 percent over a 50 year project life or recovery period was used.

TABLE I

COST OF DETAILED PLANS

	PLAN A	PLAN B	PLAN C
Construction Costs			
Breakwater	$2,058,500	$1,469,000	$1,736,500
Channel	136,000	136,000	136,000
Engineering & Design	123,500	85,000	104,200
Supervision & Administration	164,700	110,000	138,900
Total Estimated First Cost	$2,482,700	$1,800,000	$2,115,600

ANNUAL CHARGES

	PLAN A	PLAN B	PLAN C
Interest & Amortization	$188,500	$136,600	$160,600
Annual Maintenance (Breakwater)	20,000	15,000	17,000
Annual Maintenance (Channel)	2,400	2,400	2,400
Total Annual Cost	$210,900	$154,000	$180,000

BENEFIT COMPARISON

As mentioned previously, each of the detailed plans would offer sufficient protection to the users of Sakonnet Harbor to result in significantly increased landings at the harbor due to an extended fishing season. This in turn would encourage the upgrading and modernization of the fleet.

Furthermore, transportation savings could be expected to accrue under each improvement plan to fishermen who presently relocate to other ports for winter operations, as well as those who own the larger vessels that are currently forced to idle outside the harbor while waiting for high tide.

Reduction of damages to both permanently moored and transient vessels could be anticipated in equal amounts through the implementation of any one of the alternatives.

A detailed discussion of benefits is given in Appendix 5. However, a breakdown of annual benefits for all three detailed plans are shown in Table 2.

TABLE 2
ANNUAL BENEFITS

	PLAN A	PLAN B	PLAN C
Increased Net Income to Fishermen	$232,900	$232,900	$152,200
Transportation Savings	11,700	11,700	9,000
Reduction in Vessel Damages	4,500	4,500	4,500
Total	$249,100	$249,100	$165,700

Table 3 lists the benefit-cost ratios for the three detailed plans along with the net economic benefits for each plan, given on an annual basis.

TABLE 3
ECONOMIC IMPACTS

	PLAN A	PLAN B	PLAN C
B/C Ratio	1.2	1.6	1.0
Net Benefits	$16,200	$95,100	-

Net benefits being inversely proportional to project costs, indicates that Plan B, with the lowest initial project cost and annual charges, has the greatest net benefits.

ENVIRONMENTAL COMPARISON

The magnitude of environmental impacts is greatest for the proposed 750-foot breakwater in Plan A. The least environmental impact would result from the 600 foot structure proposed in Plan C. However, as stressed earlier in this report, the absolute magnitude of environmental impact for all three plans is relatively small because of the order of magnitude difference between wind-generated currents and tidal currents within the harbor.

COMPARISON SUMMARY

Table 4, entitled "System of Accounts" is a general analysis relevant to plan selection. It presents the determinative factors that underline each final alternative by displaying the significant beneficial and adverse impacts. This system is utilized for the purpose of tradeoff analysis and final decision making.

RATIONALE FOR DESIGNATION OF NED PLAN

Plan B is the alternative which maximizes net economic benefits. Net economic benefits are maximized when plan scale is optimized and the plan is efficient. Scale is optimized when the benefits of the last increment of output for each measure in the plan equals the economic costs of that

TABLE 4
SYSTEM OF ACCOUNTS

	WITHOUT PROJECT	PLAN A	PLAN B	PLAN C
A. PLAN DESCRIPTION	No Action	750 Foot Breakwater and Access Channel	500 Foot Breakwater and Access Channel	600 Foot Breakwater and Access Channel
B. IMPACT ASSESSMENT				
1. National Economic Development				
A. Annual Benefits	0	$249,100	$249,100	$165,700
B. Annual Cost	0	$210,900	$154,000	$180,000
C. B/C Ratio	0	1.2	1.6	1.0
D. Net Benefits	0	$16,200	$95,100	0
2. Environmental Quality				
A. Breakwater Impacts on Tidal Currents	-	Significant	Marginal	Least
B. Breakater Impacts on Water Quality	-	Marginal	Same as A	Same as A
C. Dredging Impacts on Water Quality	-	Significant but Temporary	Same as A	Same as A
D. Shoreline Impacts	None	None	None	None
E. Aesthetics	Favorable	Unfavorable	Unfavorable	Unfavorable
C. PLAN EVALUATION				
1. Conforms to Planning Constraints and Concerns				
A. Avoids Dredging During 1 April to 15 September	Yes	Yes	[illegible]	Yes
B. Limited to Offshore Construction	-	Yes	Yes	Yes
C. Restrains from Being Connected to Shore	-	Yes	Yes	Yes
2. Achieves Planning Objectives and Goals				
A. Provides Safe Year-Round Navigation Facilities	No	Yes	[illegible]	Yes
B. Meets Land and Harbor Use Plans	No	No	[illegible]	Yes
D. PUBLIC RESPONSE				
A. Plan Found Acceptable	No	No	[illegible]	No
E. IMPLEMENTATION RESPONSIBILITY				
A. Federal Share (%)	0	100	100	100
B. Local Share (%)	0	0	0	0

increment. A plan is efficient when the outputs of the plan are achieved in a least cost manner.

As will be explained more fully in Appendix 4, a breakwater design must consider the degree of protection afforded by the length and alignment of the structure as well as the structure's height. In the specific case of Sakonnet Harbor, the close proximity of existing and prospective facilities in relation to each other required that the variable lengths of the structure insure a comparable amount of protection. In addition, the height of the breakwater was based on a design wave and a determination of the aceptable wave height which could reach the facilities and vessels without causing undue damage.

Although it is difficult to accurately predict the impact of waves of various heights within Sakonnet Harbor, it has been determined through experiences at other harbors that a wave height of 1.5 feet would be acceptable. Every additional increase in wave height would have a negative impact or dollar loss on the activities within the harbor. Conversely, to design the structure to decrease the wave height below 1.5 feet would add to increase the cost of the structure without increasing the tangible benefits.

Thus, for Sakonnet Harbor, the plan that most efficiently optimizes scale is the one that affords an adequate degree of protection at the least cost. This would be the NED Plan, and for Sakonnet Harbor it is Plan B.

RATIONALE FOR DESIGNATION OF EQ PLAN

In designation of the environmental quality or EQ plan, it is recognized that environmental quality has both natural and human manifestations. Beneficial EQ contributions are made by preserving, maintaining, restoring, or enhancing the significant cultural and natural environmental attributes of the study area.

The present environmental quality of Sakonnet Harbor is good. The waters of the harbor are considered safe for all forms of recreational activity including swimming. The good water quality of the harbor is most likely a result of the harbor's geographic isolation from populous regions as well as its nearness to the open ocean and the resultant wind and tidal currents which serve to flush the harbor of pollutants. Consequently, in looking at detailed alternatives for harbor development, the EQ plan would be the one that has the least impact on existing harbor conditions and as a result, the least potential impact on the harbor environment.

In looking at the alternative plans considered in this study, the plan which would have the least impact on existing harbor conditions by minimizing changes to tidal current patterns, is Plan C, which includes the 600-foot breakwater realigned on a S42°W bearing. It is designated the EQ plan.

RATIONALE FOR SELECTED PLAN

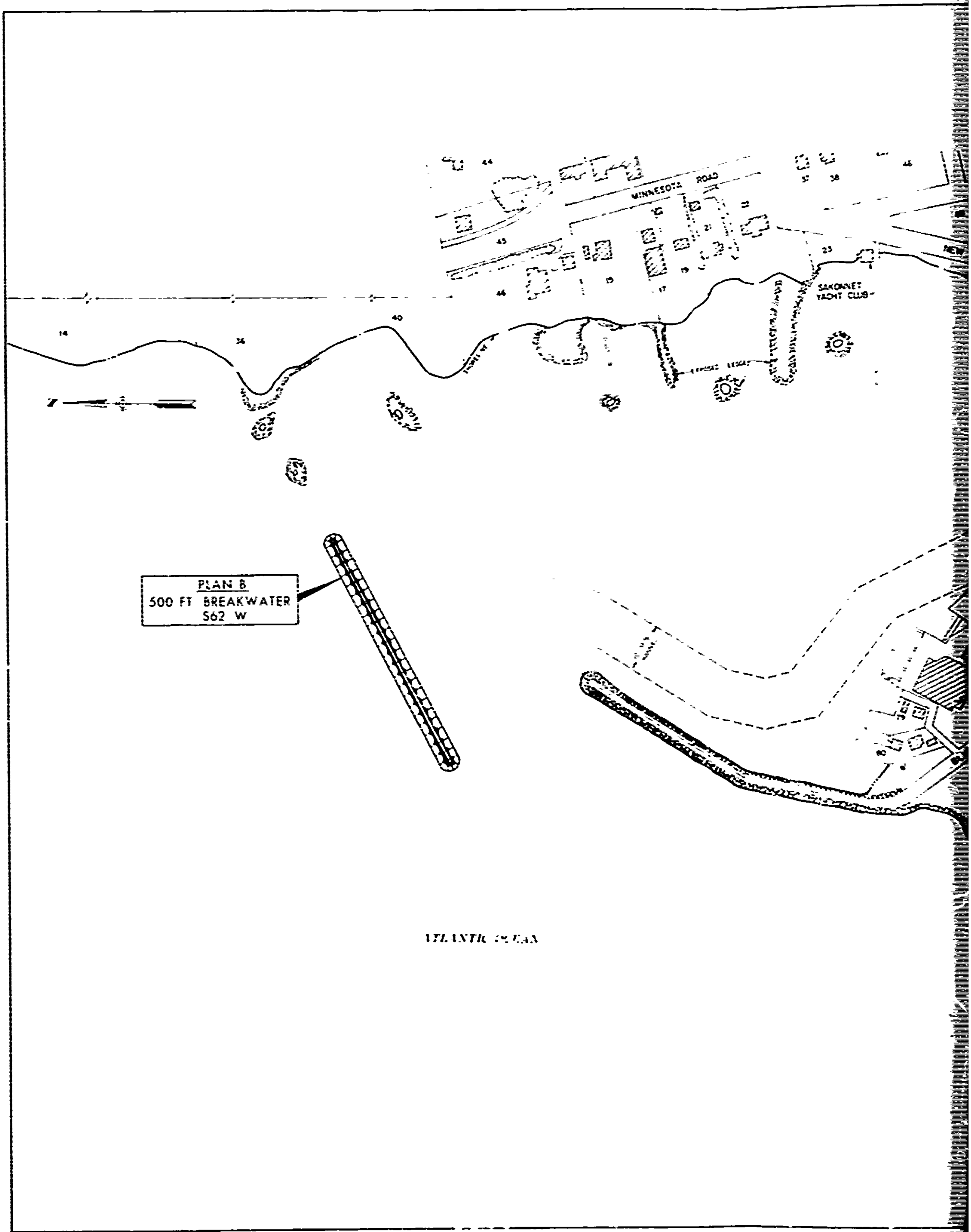
Plan B is the selected plan. Of the three alternative plans considered in detail, Plan B provides maximum net benefits while its environmental impacts are not significantly greater than Plan C which has been designated the EQ plan.

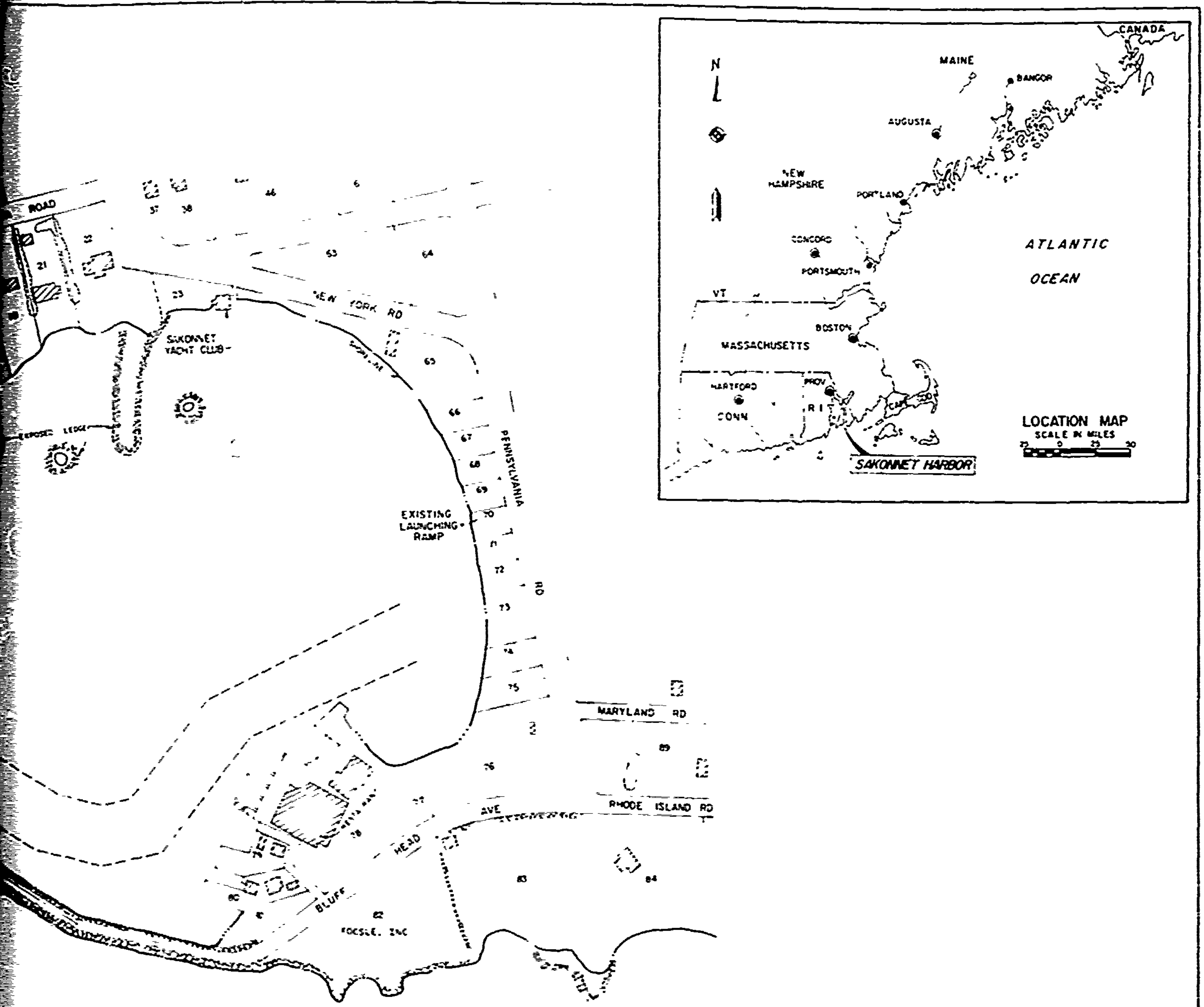
As previously mentioned, Plan B would have a more significant impact on tidal current patterns in Sakonnet Harbor than Plan C but tidal currents are not considered to be critical in maintaining flushing action in the harbor and by implication water quality. Consequently, since Plan B is over \$682,700 and \$315,600 less expensive than either Plan A or C respectively and maximizes the net benefits it has been designated the selected plan.

RECOMMENDED PLAN

The recommended plan would provide for a 500-foot rubble-mound breakwater or a bearing of south 62^{o} west running from a point approximately 450 feet offshore from a plot of land numbered 36 as shown on the town of Little Compton plot plan and on Plate I. The plan would also provide for designation of a 110 foot wide by 10 foot deep navigation channel along the westerly boundary of the existing harbor anchorage which will require dredging of approximately 8,000 cubic yards of sand and gravel.

The total construction investment for the recommended plan is estimated to be \$1,800,000. Annual benefits that would result from the recommended plan, principally increased net income to fishermen, amount to \$249,100 which when compared to annual charges of \$154,000 yield a benefit-cost ratio of 1.6 to 1.


MINNESOTA ROAD
SAKONNET
YACHT CLUB
PLAN B
500 FT BREAKWATER
S62 W



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MA

SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY
RECOMMENDED PLAN OF IMPROVEMENT
PLAN B

DATE SEPTEMBER 1980 | SCALE

PLATE III

2

ENVIRONMENTAL ASSESSMENT

INTRODUCTION AND PROJECT HISTORY

In keeping with the National Environmental Policy Act of 1969, the New England Division of the U.S. Army Corps of Engineers, has examined environmental values as part of the planning and development of the proposed action plan. Background environmental information was compiled for purposes of this report through interviews with various State and local interest groups and a search of published literature. This report provides an assessment of environmental impacts and alternatives considered and contains other applicable data to the Section 404 Evaluation requirements.

The Federal project currently provides for a breakwater, 400 feet long, in a northerly direction; a 400-foot extension in a northeasterly direction; removal of rock nearest the wharf to a depth of 8 feet; and dredging approximately 9 acres of the harbor to a depth of 8 feet.

The project was last dredged during fiscal years 1957 and 1958 when approximately 37,000 cubic yards of material was excavated and placed behind the Fo'c's'le Restaurant in what is now the parking area.

Purpose and Need for Action

Sakonnet Harbor's exposure and extreme southerly location have made it susceptible over the years to damage by northerly winds and waves. This exposure has prevented any substantive expansion of the harbor facilities, historically, the harbor has served only a limited role in the area's economy. The future use and further development of the harbor clearly depends on the implementation of improvements to provide protection from extreme weather conditions and the dominant winds which enter from the north. Increased markets for New England lobster and ocean quahogs along with the Japanese market for squid provide an opportunity for Sakonnet Harbor to assume a more significant role in the regional economy, if the desired protection is provided.

Senate and House Resolutions of May and September 1976, respectively, and instructions from the Chief of Engineers on 20 May 1976 provide the authority for conducting a feasibility study on providing improvements at Sakonnet Harbor. The feasibility study was performed and the detailed project report which documents said study was prepared under the provisions of Section 107 of the 1960 River and Harbor Act, Public Law Number 86-645, as amended.

The selected plan of improvement as shown in Plate 3 consists of the following main elements:

Provision of a 500-foot long rubble mound breakwater, across the northerly approach of the harbor. The breakwater will be aligned on a bearing of South 62^{o} West running from a point approximately 450 feet offshore from a plot of land numbered 36 as shown on the town of Little Compton plot plan.

- Delineation of a 110-foot wide, 10-foot deep channel along the existing west harbor breakwater for the commercial fleet.

- Dredging of selected areas to provide a minimum depth of 10-feet below mean low water along the main channel to accommodate offshore multi-purpose fishing boats with a length of 65 feet.

The dredging will be performed under a private contract with the Government. The quantity to be dredged is estimated at 8,000 cubic yards plus 3,000 to 4,000 cubic yards from private piers. A hydraulic pipeline dredge will be employed and disposal of the dredged material is proposed for a land area opposite the Fo'c's'le, Inc., Restaurant adjacent to the existing parking lot west of Bluff Head Ave. This disposal area is shown on Figure 4-9. The property is privately owned and is approximately 300' by 200' in area. Rock and other construction material bordering the south end of the parking lot will be relocated to dike the open seaward side of the ite. A second land area recently purchased by the town and located in the southwest of the harbor might be available for fill if needed. Local interests have also indicated a desire to expand marina facilities in this area.

ALTERNATIVES INCLUDING THE RECOMMENDED ACTION

Possible navigation improvements in Sakonnet Harbor were investigated, based on the evaluation of problems and needs identified by local interests. In considering the protection needs of the existing commercial fleet at Sakonnet Harbor and maintenance of water quality, three alternative plans of improvement were evaluated.

PLAN "A"

- Provide a new 750-foot rock rubble mound breakwater (south 62^{o} west) with faces of armor stone across the open northerly approach to the harbor.

- Delineate a 10-foot channel approximately 110-foot wide along the existing west harbor breakwater.

The total construction cost for this plan including breakwater construction dredging, contingencies, engineering design and supervision and administration fees is $2,482,700.

From an environmental standpoint the 750-foot breakwater structure in comparison with the other two alternatives would allow for the most restricted flushing of the harbor which may lead to degradation in water quality.

PLAN "B"

- All the features of Plan "A" above except the length of the breakwater would be reduced to 500 feet.

This is the selected plan based on the results and recommendations of a comparative evaluation as described in other sections of this report. The shorter breakwater, along the same alignment as originally proposed, will allow for greater circulation and water exchange in the harbor which will minimize the impacts to water quality, while allowing for optimal protection.

The total cost for Plan "B" is $1,800,000 which is significantly lower than either Plan "A" or the reoriented 600-foot structure.

PLAN "C"

- All the features of Plan "A" and "B" above except the length of the breakwater would be 600 feet and its alignment would be reoriented on a bearing of south 42° west.

This realignment would result in a 3-foot average depth increase over the breakwaters in plans A and B which will require a greater volume of rock material and thus a higher construction cost than that of Plan "B". The estimated total cost for Plan "C" is $2,115,600.

Environmentally, the reoriented breakwater would permit a greater amount of ice and wind generated turbulent water to enter the harbor through the northern opening. At the same time, however, the reorientation would also provide a greater exchange of water resulting in a less pronounced impact to water quality.

Alternative Methods of Dredging

The method of dredging used depends on the method of disposal chosen. If ocean disposal is selected, a mechanical dredge will be used. If diked disposal in some nearby area is chosen, as proposed, then a hydraulic dredge will be used. In the case of diked disposal at a more distant site, a mechanical dredge would be used. Thus, there are a few real choices once the choice of disposal method has been made.

Alternative Disposal Methods

General Discussion

Each of the possible disposal methods would have some environmental impact, whether in the ocean, on land, or in diked disposal areas near the waterfront. It is difficult to offset the impacts under such widely varying conditions against each other. The major concerns in ocean disposal of dredged materials are potential for impact on identified commercial marine resources and potential for addition to general, low-level deterioration of the overall ocean resource. Only the former can be specifically addressed. Based on the results of sediment analyses, the coarse grain size would be acceptable for open water disposal under current 404 Dredged Material Disposal guidelines.

Ocean Disposal - Brenton Reef Site

The advantages of this site are its proximity to the dredge site and its previous history of use. There is more scientific information regarding this site than any other in the area. However, there is the concomitant disadvantage of historic opposition to dumping at this site.

One advantage of disposal of the Sakonnet sands and gravel at this site would be to use it as partial cover of the finer silt-clay muds characterizing the slopes of the spoil mound. This action would decrease the amount of turbidity in the bottom waters and enhance recolonization.

Ocean Disposal - Sakonnet Harbor Dump Ground

This open water site was considered for the original Sakonnet Harbor Project but not used. It is a 3/4 mile square site in Narragansett Bay, located and described as follows:

Beginning at a point one mile due west of Breakwater Point Light in Sakonnet Harbor, thence due west 3/4 mile to a point; then due south 3/4 mile to a point; thence due east 3/4 mile to a point and thence due north 3/4 mile to the point of beginning and containing 360 acres. The depth of water ranges from 59 to 65 feet below mean low water. No scientific studies have been conducted at this site and its use for other dispcsal operations is unknown. Deposition of sand and gravel to be dredged from Sakonnet would not cause any adverse impacts to the ecosystem if dumped at this site.

At this time however, there is no State designated dumping grounds within the coastal waters of Rhode Island and ocean disposal of dredge material is considered on an individual project basic.

The town of Little Compton will be responsible for providing suitable and adequate dredge disposal sites and associated costs for proper diking of the sites for future maintenance dredging of the project. This is part of the condition of a local cooperation which was agreed to under the original project authorization.

Beach Nourishment

Another valid and constructive use of dredged sediments historically has been beach nourishment. Clean dredged sand is pumped to the beach hydraulically and left for reworking by tides, storms and currents. By conducting the project in late fall or winter, there is maximum likelihood that the beach profile will be restored by the following season. Sediments from Sakonnet Harbor could be deposited on such areas as [illegible] Beach or Warren Point Cove. The State's Coastal Resources Council would not object to disposal of such material on town property and would support placement of materials at Warren Beach Club property to investigate natural erosion procedure. The coarse nature of the material to be dredged is compatible with existing sediments at both of these locations.

No Action

If Sakonnet Harbor is to take full advantage of the new opportunities created by the 200-mile offshore limit and the increasing market demand for lobster and ocean quahogs, commercial fisheries there must become a year-round operation. This can only be achieved if the harbor is protected from the northerly winds of winter. Accordingly, the "no improvement" option is neither consistent with the new opportunities for growth and economic vitality at Sakonnet Harbor, nor does it conform with local and State development plans for expansion of commercial fisheries in Rhode Island.

ENVIRONMENTAL CONSEQUENCES

Beneficial Impacts

3.01 The future economic growth of commercial fisheries at Sakonnet Harbor depends largely on whether or not protection is provided. In the absence of a protection plan, it appears that the size of the commercial fleet will remain stable as it has over the last ten years. Although the efficiency of the fleet has improved in recent years, as evidenced by a continuing effort to upgrade equipment and diversify fisheries, full modernization of the fleet and extension of the fishing season to include the winter months will only occur if a protection plan is implemented. Over the long run, as advancement in the fishing industry render the mode of operation out of Sakonnet Harbor obsolete, an inability to compete with fully modernized fleets at nearby ports may result in local economic decline.

The total catch landed at Sakonnet Harbor in 1978 was estimated to be 4,206,441 pounds valued at $1,363,501 by the National Marine Fisheries Service, including all lobster, shellfish and finfish. The construction of a breakwater could significantly increase this total by providing an incentive for those vessels not already geared up for gillnetting to do so, by allowing those 15 boats which are normally hauled ashore for the winter to operate year-round if they so desire, and by providing additional fishing days which were lost previously due to an inability to navigate the harbor during rough seas. In addition, financial gains would accrue to the fishermen in the form of reduced damages to the fleet and decreased transporatation costs for those vessels which are normally transferred to alternative ports for the winter.

Probable Environmental Impacts

Sediments

Test borings taken 7-11 March 1977 along the proposed breakwater alignment showed the bottom sediments to be composed of gravelly silty sand with shell fragments. Coarse to fine sandy gravel was found to 7.6 ft. below the existing water-sediment interface. Two grab samples taken within the harbor were visually classified as silty sandy gravel and silty fine sand respectively with traces of organic material.

According to the 404 guideline for the discharge of dredged or fill material (Fed. Register, 5 September 1975, para. 230.4(b)(1) p. 41294) further evaluation of chemical-biological interactive effects is not necessary because the sediments meet the following evaluation criteria:

(i) composed predominantly of sand, gravel or any other naturally occurring sedimentary material with particle sizes larger than silt...

(ii)(a) The site from which the material proposed for discharge is to be taken is sufficiently removed from sources of pollution.

(b) Adequate terms and conditions are imposed on the discharge of dredged fill material to provide reasonable assurance that the material will not be moved in currents or is otherwise damaging to the environment outside of the disposal area.

The sampling results reveal that the sediments to be dredged meet the current EPA criteria for dredging and disposal pursuant to Section 404(b) of the Federal Water Pollution Control Act Amendments of 1972.

PROBABLE IMPACTS OF DREDGING

There are several potential impacts of dredging within the harbor:

Water Column Impacts

Dispersion of sediments will cause a temporary increase in suspended and dissolved solids. This will increase turbidity, diminishing light available for photosynthesis for the short term in localized areas. Turbidity changes associated with dredging have been shown to be temporary and local. Studies of clamshell dredging in the Thames River (Connecticut) have shown that perturbations are limited to within 500 feet of dredging activity (1). The coarse grain size of sediments at Sakonnet and the fact that a hydraulic dredge will be utilized in which materials are sucked back into the pipeline system will significantly reduce suspension of materials in the area of the dredge.

Dispersion of sediments during dredging may facilitate release of toxic materials into solution. Laboratory studies by Dredged Material Research Program indicate that certain trace metals may be released in the parts per billion (ppb) range while others show no release pattern. Soluble pesticides released into the water column are negligible (2 & 3). Since the greatest concentrations of heavy metals and other contaminants are known to be associated with silt-clay sediments little or no impact of such release would be predicted at the dredge site.

Benthic Impacts

Removal of those organisms within the dredged sediments is an unavoidable result of dredging. Mobile species such as finfish, crabs and lobster will attempt to avoid the actual area of dredging. Recolonization of the dredged area will eventually occur. Recolonization of areas impacted by dredging has been demonstrated within a period of approximately 1 1/2 years in Chesapeake Bay (4). Abundance of dominant species and observed number of species were reduced following dredging, but returned to predredging levels the following year. The new breakwater will provide ample surface area to the attachment of a variety of algae and invertebrates. Essentially then, we have a substitution of habitat types (sand-gravel for a hard rock surface) and biota (burrowing or infaunal organisms for epifauna species). No commercial fishing or shellfishing takes place in the harbor.

Archeological and Endangered Species Impacts

Dredging should not have any impact on known historic sites since these are at some distance from the actual dredge area. The Rhode Island Historical Preservation Commission has informed the Corps (letter 11

April 1978) that the proposed breakwater area is in water that is not archeologically sensitive and that the dredging will not affect any cultural resources.

Dredging will have no impact on endangered species.

Other Impacts. Dredging could conceivably have a major impact on commercial and recreational use of the harbor. This impact could be minimized by dredging in late fall or winter.

Many biological impacts would also be minimized by late fall or winter dredging. Very few animals spawn in winter, and many species are dormant or buried.

Impacts of Blasting

Removal of ledge rock and boulders would require drilling and blasting with dynamite. The lethality of an explosive is directly related to its detonation velocity, charge weight and density of material to be blasted. Most explosive when detonated in a rock or clay substrate produces low level over pressures, with subsequent reduced lateral or vertical pressure charger. The confined nature and timing of the detonation will aid in minimizing the overall impacts. Some mitigation measures that can be used include the use of warning charger (dynamite or pulsed electrical currents) outside the perimeter of the proposed work area to scare away any large fish schools or mobile invertebrate animals; scheduling of blasting to avoid peak periods of fish migration and spawning; and submerge the charges below the mud line which will buffer the pressure shock wave.

It is anticipated that the amount of blasting to be performed will not result in any significant loss of fish and lobster and would not significnatly affect the food web or natural productivity of the immediate area. Further, no significant loss of habital area would occur as a result of the proposed blasting activity.

Probable Impacts of Diked Disposal

Turbidity and Water Quality

When the dredged materials, comprised of a mixture of solid material, water and suspended material, are deposited behind a dike, they are ususally detained for a period of time in order to allow maximum settling of the suspended material. The "clean" overlying water is then released, leaving the moist dredged material behind. However, if the overlying water is released before all the suspended material has settled, there may be problems of turbidity, nutrient release and/or contaminant release to adjacent waters. Turbidity will decrease light penetration and may reduce the dissolved oxygen concentrations in the water. These decreases may adversely affect various marine life

forms, as discussed in Section 3.08 above for the dredging site. The turbid condition will decrease as the particles travel away from the outlet and become diffused into the adjacent waters. Because the disposal area will be diked and the coarse nature of the sediments any turbidity generated by the discharge will be minimal and of short duration.

Odor

Objectionable odors may arise from confined dredged materials in the disposal area, most probably as a result of hydrogen sulfide (H_2S) given off by anaerobic bacterial breakdown of organic materials. Sediment analysis of Sakonnet dredge materials show a low percentage of organics and therefore odors from H_2S deposits should be minimal.

Safety and Health Hazards

The safety of the disposal area to humans and animals is dependent on the measures taken to restrict access to the area. Until the diked material has sufficiently consolidated, it may not support a person walking on it. This condition is expected to last for only a short period (days or weeks) because of the coarse material of the sediments.

The dike itself should not pose any great safety problems except as an access point to the spoil area. Maintenance of the dike would be required on a periodic basis to prevent erosion and failure of the dike. Maintenance of drainage facilities must also be done as settlement changes the surface profile.

During and subsequent to dredging operations, no one should be allowed on the dike or have access to the pond area. The entire area should be closed to the public until placement of fill material or consolidation of dredge material is complete. Again, the coarse nature of the sediments will afford rapid drainage and drying.

Plant Life

The dredged material is not expected to affect nearby plant life, however, plant life now existing at the disposal site will be lost.

Noise

During the dredging operations, a problem with noise from the dredge and discharge pipe may arise. This is a short-term problem and can probably be treated as such if complaints arise. Arrangements with the contractor would be made for work hours which would be compatible with residents. Noise is not expected to be a major problem during construction of this project.

Atmospheric Conditions

Construction activities associated with the proposed action will have negligible direct impact on existing conditions. Emissions from combustion engines will be dispelled by prevailing winds and although contributory to overall air degradation, are not judged to be significant.

Secondary effects to air quality degradation may arise out of the proposed commercial marina expansion. By providing additional berths and moorings for boats, increased fuel emission levels from the boats and from the increased number of vehicles that would travel to the marina can be expected. Any increase however would be seasonal and is not expected to add significantly to that experienced with the annual 3000 increase in summer resident population. Prevailing winds will continue to dispell fumes and push them further inland.

PROBABLE IMPACTS FROM THE PROPOSED BREAKWATER

Water Quality

A quantitative hydrographic model located in Appendix 4, was used to obtain information about current circulation changes and effects on flushing related to the construction of a new breakwater. Predicted values were compared to observed data to demonstrate the validity of the model.

To maintain good water quality you must maintain an adequate exchange of harbor water with the Sakonnet River water. The basic force which operates in the movement of water is currents. There are two types of currents; tidal and wind generated. The observed current field in Sakonnet Harbor is determined by the wind and a southward regional flow in the Sakonnet River outside the harbor. Wind generated currents account for as much as 90 percent of the total flushing action. While all of the breakwater plans considered impact on tidal currents, none of them would significantly alter wind generated currents. Therefore, based on model predictions, construction of a breakwater would not have a significant impact on water quality within the harbor.

Flow at the entrance to the harbor along the inside of the breakwater, which determines the rate of flushing the harbor, is significantly affected by the type of breakwater built. The minimum flow will occur with the 750-foot breakwater (Plan A).

There would be about 100,000 m^3 flow through the west inlet with this longer 750-foot breakwater. The flow would be increased by 50% should the breakwater be shortened. All of the increased flow would move out of the North Inlet (the area between the breakwater and shoreline). Reorienting the breakwater would increase the flow by 85%, as most of the water would move out through the North Inlet.

The cross-sectional area of the North Inlet is different for each breakwater plan. Plans B and C, the shortened and reoriented breakwaters respectively, allow for roughly the same cross-sectional North Inlet areas. However, Plan C, because of its orientation to the wind and current flow in the Sakonnet River allows for a greater velocity of flow through the inlet than Plan B. Plan A would result in a cross-sectional area for the North Inlet of about one third the size of either Plans B or C. Because of this Plan A would greatly restrict the flushing of the northeastern section of the harbor. The increased volume of flow afforded by Plan C would also, however, increase the amount of ice transported into the harbor around the breakwater.

For existing conditions, the model predicted a tidal prism of ap[illegible] [illegible]ely 60 to 70,000 m^3 of water which passes the harbor [illegible] volume will not change as a result of breakwater construction [illegible] the distribution of the total flow volume through the two [illegible] change with each plan resulting in differing degrees of flushing [illegible] selected areas of the harbor. Flow Flow through the north inlet [illegible] be limited by construction of the proposed breakwater. But flow will increase by about three times if the breakwater is shortened and by about four times if the breakwater is reoriented. The biggest trade-off with the reoriented structure is in terms of ice accumulation versus flushing and economics.

Effects on Surface Pollution

The construction of any structure across the mouth of a harbor or cove will result in the trapping of some floatable debris and surface pollutants such as oil. The problems of possible increased pollution inside the harbor is an unavoidable trade-off for shelter and safe moorage of commercial and recreation craft. Attempts to possibly minimize the problem has been accomplished by investigating several breakwater configurations.

The wind-driven circulation increases the flushing rate over flushing due solely to tidal action. Because this circulation may vary with depth, the types of pollutants influence their flushing rates/ For example, if the pollutant floats, i.e., "flotsam and jetsam" or oil and gas a northwest or southwest wind would cause it to collect in the inner confines of the harbor. If the pollutant is the type which disperses throughout the water column, i.e. fluid fish waste water discharges, etc., then this pollutant would be flushed from the harbor under all wind conditions. If the wind is directed into the harbor, the pollutant would be flushed out in the near bottom return flow. If the wind is directed out of the harbor, it will be flushed out in the near-surface flow.

Consideration was given to the following breakwater design features and their relationship to water quality:

(1) shortening the breakwater to 500 feet, and thereby widening the opening between it and the shore;

This design will increase the volume of water entering the harbor between the shore and the breakwater. This configuration is best in terms of flushing the harbor and minimizing collection in debris along the inside of the harbor.

(ii) changing the angle of the breakwater to NE-SW, so that the prevailing SW winds and swells wash flotsam and jetsam parallel to the breakwater rather than against the south side of it;

This design is not as efficient as the design in (i) for this adverse effect. This design may decrease the probability of wave reflection in the harbor. However, this alignment does not obstruct natural current flow patterns and is equal to (i) in its flushing capacity.

The selected Plan "B" providing for a 500-foot breakwater is thought to represent the best all around choice to provide the required protection from wind and wave conditions while still allowing for adequate flushing and water circulation within the harbor.

The proposed commercial marina expansion as well as the proposed Federal dredging is subject to Section 401 of the Federal Water Pollution Control Act (FWPCA) which requires all persons proposing an activity which may result in a discharge to the navigable waters to obtain State water quality certification. State certification cannot be given unless it has been determined that the proposed activity will not violate State water quality standards and effluent limitations. The proposed project will require State certification from Rhode Island. Section 402 establishes a National Pollutant Discharge Elimination System (NPDES). Under this system, all activities resulting in a discharge to the navigable waters must be registered with the Environmental Protection Agency (EPA). Administration of the system can be delegated to the State providing that two conditions are satisfied: 1) The State must have a water quality management plan deemed adequate by EPA to fulfill the goals of FWPCA; and 2) The State must have the institutional framework and legal authority to implement their plan. Rhode Island has met these requirements, and it now administers the NPDES permit program which it has combined with the State certification procedure.

The Department of Environmental Management, Rhode Island, has permit issuing authority and administers the State certification procedure. Before they will issue a discharge permit, they must determine that the project will not cause a permanent violation of water quality standards.

HUMAN SYSTEMS AND RESOURCE

Population - The proposed project is expected to have minimal impact on the future population of Little Compton. Any commercial development encouraged by the small number of additional moorages will have little effect on current population mobility patterns.

Transportation - The traffic relating to the transportation of fishery products is viewed as an insignificant addition. The total landings are projected to be less than those reported for the late 60's and early 70's. The increase will occur principally in the winter time after the traffic congestion associated with summer visitors is substantially reduced. The improvement of the marina could result in the addition of 10 or 12 additional slips. These would generate an incremental increase in traffic in the summer time but the increment can be expected not to exceed 10 percent.

AFFECTED ENVIRONMENT

Ecosystem Classification

According to Odum et al's (1974) classfication of coastal ecological systems Sakonnet Harbor represents a "neutral embayment" environment (7). A neutral embayment is a partially enclosed coastal area which receives negligible river drainage and is characterized by low turbidity and sedimentation rates, relatively constant salinity and seasonal variation is biota. Circulation patterns in a neutral embayment are primarily controlled by the interaction of the amount of wind stress on the surface waters, tidal changes, temperature structure and configuration of the harbor.

Tides and Currents

General - Base line data on tide elevations and current velocities was collected during a two week period in February 1979. The results of the field survey was incorporated in a hydrographic model used to obtain more information about current circulation changes related to the construction of the proposed breakwater. The model predicted currents and tides in the harbor. Predicted values were then compared to observed data to demonstrate the validity of the model. It was then used to predict changes in the velocity field resulting from the proposed breakwater.

Tides

The maximum high water at Mooring 1 was 2.7 ft. above MLW. Maximum low water was 2.9 ft. below MWL. Mean high and low tides, relative to MWL, were 1.7 ft. and -1.5 ft. respectively. The mean tidal range was 2.4 ft.

Comparison with the NOAA-NOS (1979) Tide Tables indicated the measured tidal range outside the harbor was 0.7 ft. lower than the predicted range. The measured high tides averaged 1.1 ft. lower than the predicted. Low tides averaged 1.3 ft. lower than predicted. Mean observed times of high and low tides were earlier than the predicted, 1 hr. 6 min. and 1 hr. 16 min., respectively.

The maximum high water inside the harbor was 2.7 ft. above MLW. Maximum low water was 2.6 ft. below MWL. Mean high and low tides, relative to MWL, were 1.6 ft. and -1.5 ft. respectively. The mean tide range was 3.1 ft.

Comparison with the tide tables indicated the measured tidal range was equal to the predicted tidal range, 3.1 ft. The measured high tides averaged 1.3 ft. lower than the predicted. Low tides averaged 1.5 ft. lower than predicted. Mean observed times of high and low tides were earlier than the predicted, 35 min. and 45 min. respectively.

Currents

Continuous monitoring of current velocities was performed at two locations (Fig. 4). Mooring I was outside the existing breakwater in the entrance. Current speed and direction were measured 3.3 ft. above the bottom. Twenty-seven days of data were collected.

Current speeds were generally low. Seventy-eight percent of the speeds were below 0.06 kn. The predominant directions of flow were south to southwest (180^{o} -225^{o}), with a mean speed of 0.07 kn. Highest mean speeds were associated with northwest to west-northwesterly flows, and average 0.17 kn. The highest speed recorded during the sampling period was 0.29 kn, from the southwest (224^{o}).

Mooring 2 was within the main channel of Sakonnet Harbor. Current speed and direction was measured 3.3 ft. above the bottom. Twenty days of data were collected at this mooring.

Speeds were low within the harbor. Seventy-two percent of the readings were below 0.06 kn. The predominant direction of flow was northwest to north (315^{o}-0^{o}). Highest mean speeds were from the east-northeast, 0.07 kn, and the northeast, 0.10 kn. The highest speed measured at Mooring 2 was 0.24 kn, from the northeast (48^{o}).

Currents profiles were also monitored at three stations in Sakonnet Harbor and its vicinity on both the flood and ebb tides of March 29 and 30, 1979. Current speed and direction was measured from a double-anchored boat using a Bendix Q-15 current sensor cabled to a Bendix Model 270 recorder on deck. Currents were measured for 3 to 5 minute intervals 3.3 ft. below the surface, approximately 0.6 times depth and 3.3 ft. above the bottom. Each station was visited up to seven times during each tidal stage (ebb or flood). A total of 39 profiles were obtained.

Natural Resources

Finfish and Shellfish - The U.S. Fish and Wildlife Service reports (letter 30 April 1979) that "no commercial fishing or shellfishing takes place in the harbor."

They indicate that there is a small amount of sportfishing in the harbor. The most intensive fishing takes place from the existing breakwater on the river side, for such species as striped bass, tautog scup, blue fish, winter flounder and Atlantic mackerel.

There is also some recreational shellfishing for surf-clams Mya within the harbor.

Historical - Archeological Features - The town of Little Compton has a rich and varied history and contains many points of historical and archeological interest. The Sakonnet Point area, in particular, is a district which contains several sites and structures which are being considered for inclusion in the National Register of Historic Places. The Rhode Island Historical Preservation Commission has reviewed the proposed construction and finds no conflict with architectural or archeological sites of importance.

REFERENCES

Section III - Environmental Consequences

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Section IV - Affected Environment

6. Small Navigation Project Sakonnet Harbor, Little Compton, Rhode Island. Detailed Project Report. New England Division, Army Corp Engineers. April 1978.

7. Coastal Ecological Systems of the United States. Vol. 2. edited by H.T. Odum, B.J. Copeland and E.A. McMahan. 1974. The Conservation Foundation, Washington, D.C.

8. U.S. EPA and Rhode Island Division of Fish and Wildlife. State of Rhode Island Shellfish Atlar. September 1974.

9. Hydrographic Analysis at Sakonnet Harbor, Little Compton, Rhode Island for Small Navigation Project Prepared for Dept. Army, New England Division Corps of Engineers. Normandeau Associates, Inc. April 1979.

FINDING OF NO SIGNIFICANT IMPACT

The project as proposed calls for construction of a 500-foot rubble-mound breakwater and the removal of approximately 8,000 cubic yards of material. Disposal of the dredged material would be at a land site provided by local interests. The project will provide for the utilization of Sakonnet Harbor on a year-round basis by the commercial fishing fleet.

The determination to prepare an Environmental Assessment, as opposed to an Environmental Impact Statement, was based on the following considerations:

The commercial nature of the project will complement and enhance local land use.

The Hydrographic Analysis indicates minimal impact to water quality within the harbor.

The availability of a suitable land disposal site and rapid consolidation of the material will quickly allow the site to be utilized for local land use needs.

Coordination with appropriate Federal and State agencies insured that concerns and suggestions were made known to the Corps so that these concerns could be addressed during project planning.

9 January 81
DATE

William E. Hodgson
WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

CONCLUSIONS

As Division Engineer of the New England Division, Corps of Engineers, I have reviewed and evaluated in the overall public interest all pertinent data concerning the proposed plan of improvement, as well as the stated views of other agencies and the concerned public, relative to the practical alternatives in providing navigation improvements in Sakonnet Harbor, Little Compton, Rhode Island.

The possible consequences of alternatives have been studied according to engineering feasibility, environmental impacts, economic factors of regional and national resource development and other considerations of social well-being and the public interest. The ramifications of these issues have been considered in detail in the formulation of this plan of improvement as outlined in this report.

In summary, there are substantial benefits to be derived by providing the present and anticipated commercial vessels in Sakonnet Harbor with a safe year-round navigational system.

It is noted that the improvement would cause a minor disruption of the environment during construction of the breakwater and access channel. However, as those impacts are not considered significant, an Environmental Assessment has been performed in lieu of an Environmental Impact Statement. Due to the significant benefits attributable to the commercial fishing industry, it is considered that this adverse environmental effect would be more than offset by the improvement in the overall economic growth of the region.

I find that the proposed action, as developed in this report, is based on a thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objective, that wherever adverse effects are found to be involved, they cannot be avoided by following reasonable alternatives and still achieve the specified purposes; that where the proposed action has an adverse effect, this effect is either ameliorated or substantially outweighed by other considerations. The recommended action is consistent with national policy, statutes, and administrative directives, and should best serve the interests of the general public.

RECOMMENDATION

The Division Engineer recommends that modification of the existing Federal navigation project at Sakonnet Harbor, Little Compton, Rhode Island be authorized by the Chief of Engineers under the provisions of Section 107 of the River and Harbor Act of 1960, as amended.

The project would provide for a 500-foot rubble-mound breakwater and a 110 foot wide by 10 foot deep navigation channel to the commercial facilities within the harbor and expansion of the Federal anchorage at a cost of $1,800,000. Since the benefits attributable to the improvement are entirely commercial in nature, the entire cost of construction as well as all future maintenance costs will be borne by the Federal Government.

The recommendation is made subject to the conditions that local interests will:

(1) Provide, maintain and operate without cost to the United States, an adequate public landing with provisions for the sale of motor fuel, lubricants and potable water open and available to the use of all on equal terms.

(2) Provide without cost to the United States all necessary lands, easements and rights-of-way required for construction and subsequent maintenance of the project including suitable dredged material disposal areas with necessary retaining dikes, bulkheads and embankments therefor.

(3) Hold and save the United States free from damages that may result from construction and maintenance of the project.

(4) Accomplish without cost to the United States alterations and relocations as required in sewer, water supply, drainage and other utility facilities.

(5) Provide and maintain berths, floats, piers, and similar marina and mooring facilities as needed for transient and local vessels as well as necessary access roads, parking areas and other needed public use shore facilities open and available to all on equal terms. Only minimum, basic facilities and service are required as part of the project. The actual scope or extent of facilities and services provided over and above the required minimum is a matter of local decision. The manner of financing such facilities and services is a local responsibility.

(6) Assume full responsibility for all project costs in excess of the Federal cost limitation of $2,000,000.

(7) Establish regulations prohibiting the discharge of untreated sewage, garbage, and other pollutants in the waters of the harbor users therof, which regulations shall be in accordance with applicable laws or regulations of Federal, State and local authorities responsible for pollution prevention and control.

Acknowledgement and Identification of Personnel

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SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

PROBLEM IDENTIFICATION

APPENDIX 1

PREPARED BY THE
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

PROBLEM IDENTIFICATION

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PROBLEM IDENTIFICATON

SECTION A

ANALYSIS OF EXISTING TRENDS AND CONDITIONS

1. This appendix contains information supplementing the first two sections of the Main Report, Introduction and Problem Identification and documents previous studies and reports, describes the existing and projected future (without project) conditions, outlines problems and needs identified in the study area and sets forth the national objectives, the planning objectives, and constraints developed for this project.

PRIOR STUDIES AND REPORTS

2. Several Federal reports on navigation improvements in Sakonnet Harbor have been published. These have resulted in approved Federal projects providing for an 800-foot breakwater across the westerly approach to the harbor and a 12-acre anchorage dredged to a minimum depth of 8 feet below mean low water. Pertinent data on these reports in presented in Table 1-1.

LOCATION

3. Sakonnet Harbor, originally known as Church Cove, is located in the southwestern part of the town of Little Compton, Newport County, Rhode Island. It is about 30 miles southeast of Providence, Rhode Island and 5 miles east of Newport, Rhode Island. The harbor is located at the eastern side of the entrance to the Sakonnet River, and directly adjoins the Atlantic Ocean at Block Island Sound. See Plate I of the main body of this report for the location and graphic representation of the project area.

4. In addition to the Atlantic Ocean and the Sakonnet River, the study area adjoins Block Island Sound to the south and has a straight line approach to the Cape Cod Canal to the east and Long Island Sound to the west. Narragansett Bay is accessible by sailing up the Sakonnet River and under the Sakonnet and Mount Hope Bridges. Newport Harbor is about 15 miles to the west by water. Access to the large ports of Boston, Providence, and New York City is readily available by both land and sea routes.

5. The specific geographic area which this study will address includes the immediate harbor vicinity and the entire town of Little Compton. Anticipated impacts will also be generally discussed in the context of their effects on the economics of Newport County and the State of Rhode Island.

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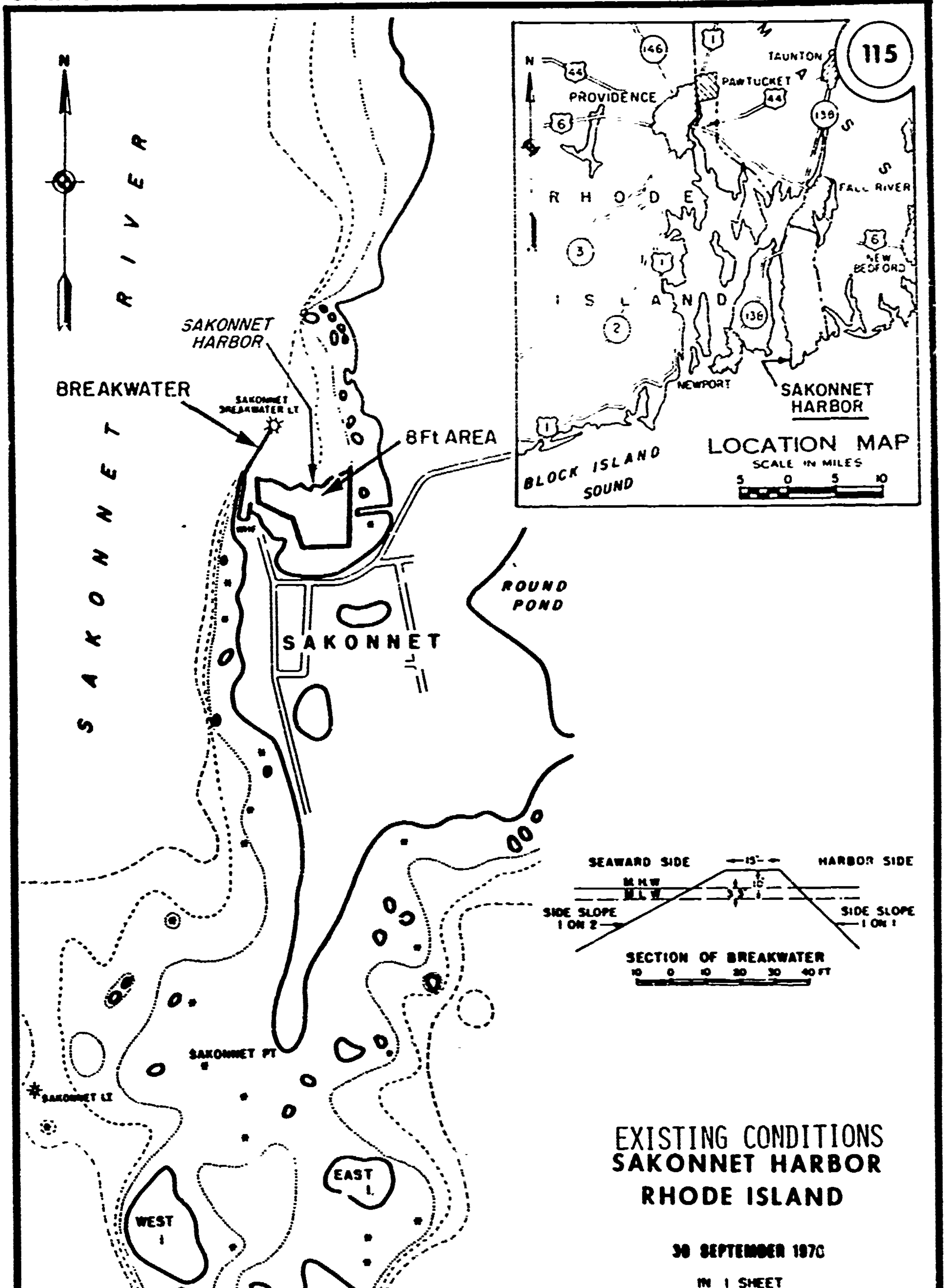

Figure 1-1

TABLE I-1
SUMMARY OF PRIOR STUDIES AND REPORTS

Published In	Nature of Report	Work Considered and Recommendation
H. Doc. No. 154, 20th Cong., 1st sess., 1828	Survey and examination.	Breakwater 400 feet long. Favorable.
Annual report Chief of Engineers, 1889	Preliminary examination.	Restoration of a portion of breakwater that has been previously built, and dredging of a small area of the cove for increased anchorage. Favorable.
Annual report Chief of Engineers, 1895	....do....	Raising and lengthening breakwater and marking or removing isolated rocks in harbor. Survey recommended.
H. Doc. No. 81, 55th Cong., 1st sess., 1897	Survey.....	Extending the old breakwater northerly to a rock (about 200 feet) and raising the whole structure to 8 feet above mean low water with a top width of 15 feet. Favorable.
H. Doc. No. 99, 56th Cong., 2nd sess., 1900	Preliminary examination and survey.	Removal of large rock nearest the wharf to a depth of 8 feet. Favorable.
H. Doc. No. 264, 62nd Cong., 2nd sess., 1910	Preliminary examination	Dredging to a depth of 12 feet at mean low water an area 150 to 200 feet wide just east of the breakwater. Removal to a depth of 12 feet the rock removed to a lesser depth under the earlier project and further extension of existing breakwater. Unfavorable.

TABLE I-1 (Cont'd)
SUMMARY OF PRIOR STUDIES AND REPORTS

Published In	Nature of Report	Work Considered and Recommendations
Unpublished report of the Chief of Engineers, 1928	....do....	3 plans for creation of harbor of refuge by extending existing breakwater and constructing either a detached breakwater or 2 detached breakwaters. Unfavorable.
Unpubli[illegible]d report [illegible] the Chief of Engineers, 1941	Preliminary examination and survey.	A desired plan comprising (a) a 200 foot extension to existing breakwater; (b) a 300 foot detached breakwater (c) a 6 ft. anchorage; (d) removal of ledge rock to 8 ft.; and (e) removal of isolated rocks to 8 ft., and an alternate plan comprising a 400 foot detached breakwater and items (c) and (e) above. Unfavorable.
H.D. No. 436, 82nd sess., 1952	Survey....	(a) a 400 ft. extension of west breakwater; (b) dredging anchorage to 8 feet. Favorable.
November 1969	Survey.... (Review of Reports)	A 850 foot stone breakwater from east side of harbor entrance. Unfavorable.

POPULATION

6. The most recent available U.S. Census count for 1970 listed the total resident population of Little Compton as 2,385 making the town the third

Table I-2 POPULATION

	1950	1960	1970	1980	1990
Little Compton	1,556	1,702	2,385	2,700	2,900
Newport County	61,538	81,405	94,228	79,200	85,900
Rhode Island	791,896	859,488	949,723	961,000	1,031,000

Source: 1950-1970 - U.S. Bureau of the Census
1980-1990 - Projections of Rhode Island Department of Economic Development

smallest in the state. Local officials estimate the current population to total approximately 2800, a figure slightly exceeding projected estimates for 1980. As the data in Table I-2 indicates, the rate of growth in Little Compton greatly exceeded those of Newport County and Rhode Island as a whole over the decades 1960-1970 and 1970-1980. During the earlier of these two periods, 1960-1970, the population of Little Compton increased by 40.1% as compared with 15.8% in the county and 10.5% statewide. Although the projected total increase from 1970-1980 is much smaller at 13.2%, it greatly exceeds the expected statewide increase of only 1.2%. By 1980, the total population of Newport County is expected to show a 15.9% decrease over the preceding 10 years due to extensive cutbacks or elimination of military operations at Newport and Middletown. According to projections of the Rhode Island Department of Economic Development, population growth in Little Compton and the State is expected to continue at rates of 7.4% and 7.3%, respectively, for the 10 year period 1980-1990, with a corresponding rate of 8.5% for Newport County. It must be noted that these projections are conservative when compared with those of local interests, which anticipate a total population between 4,000 and 4,500 by 1990 according to a recent report by the Little Compton Planning Board and Conservation Commission entitled Comprehensive Community Plan.

7. Population figures may be deceiving if the seasonal increase is not taken into consideration. Although the increase due to summer dwelling occupancy cannot be accurately determined, local interests estimate that population roughly doubles, increasing by 1,800 to 3,000 persons. These summer residents contribute significantly to the town's economy through property tax revenues and increased commercial activity, demanding few community services in return.

HOUSING

8. Approximately 930 year-round and 450 seasonal dwelling units exist in Little Compton at the present time, with single family structures predominating. Residential construction has accelerated in recent years to an average of 25 to 35 units per year.

9. Although available housing condition data in Little Compton is limited, the town's Department of Community Affairs estimates that 5 to 7% of the existing units may be substandard and that a substantial portion of this housing need could be corrected through rehabilitation efforts. The appropriate town agencies and boards have attempted to establish a continuing liaison with State agencies in the development of housing need data and housing related programs, with the eventual goal of a housing assistance program for those in need. The Comprehensive Community Plan also calls for revision of the towns Zoning Ordinance to increase opportunities for a variety of housing types and residential environments consistent with community goals and natural characteristics.

ECONOMIC CHARACTERISTICS

10. Economic data for the town of Little Compton is scarce due to the fact that the U.S. Census does not publish employment and income data for towns with a population of less than 2,500. Data available from the Rhode Island Department of Economic Development for 1977 lists total covered employment in Little Compton as 175, employed by a total of 57 firms with total wages of $261,312. Local officials estimate that the unemployment rate ranges from approximately 7% in the summer months to 13% in the winter months, which would exceed the range of unemployment for 1978 in the nearby Newport Labor Area of approximately 5-10%. Agriculture, seasonal business activity, and fishing are the most significant elements in the local economy, and much of the unemployment problem stems from the seasonal nature of these industries. No manufacturing enterprises are located in the town, and there is little potential for industrial development due to the lack of utilities to serve industry. Employment f. . Little Compton residents is largely centered in Newport County and Southeastern Massachusets, with minor employment in the Providence-Pawtucket-Warwick metropolitan area.

11. Agriculture has been an important source of income in Little Compton since it was settled by farmers from Plymouth and incorporated as a town in 1746/7. The industry continued to flourish as Portugese immigrants supplied the necessary manpower to farm the land of 7th and 8th generation landowners. Productive dairy farms still exist in Little Compton, and substantial crops of potatoes and cattle fodder are still produced in the town.

12. Another indication of relative economic well-being of a community is median family income. As presented in Table I-3 available U.S. Census data for 1959 and 1969 list an increase in median family income from

$5,146 to $9,422, reflecting an 83.1% growth, in Little Compton. This 10 year growth rate was approximately equal to that of Newport County, 83.5%, and exceeded that of the State of Rhode Island, 74.2%. In actual dollar terms, median family income in Little Compton slightly exceeds Newport County, the lowest county in the state, but is slightly less than the median level for Rhode Island as a whole.

Table I-3 MEDIAN FAMILY INCOME

	1959	1969	% Increase (1959-1969)
Little Compton	$5,146	$9,422	83.1
Newport County	4,997	9,170	83.5
Rhode Island	5,589	9,763	74.2

Source: U.S. Bureau of the Census, 1970

13. Percentage distribution of the Little Compton population by income group allows a more accurate appraisal of the town's economic condition. Table I-4 demonstrates that the percentage of total families in the two lowest income groups is significantly smaller than the corresponding percentages for Newport County and the State of Rhode Island. The total percentage of families categorized in the highest income group, over $15,000, was greater in Little Compton than in both the county and the state. The vast majority of the population in all three designated areas falls into the middle income brackets between $4,000 and $15,000, including 70.8% of Little Compton, 65.9% of Newport County, and 68.8% of Rhode Island. Overall, it appears that Little Compton's population enjoys a relatively high level of income as compared with the county and state in which it is located.

Table I-4 PERCENTAGE DISTRIBUTION BY INCOME GROUP (1969)

	# of Families	Under $2,000	$2,000-3,999	$4,000-6,999	$7,000-9,999	$10,000-14,999	15,000 & over
Little Compton	582	3.8	4.1	20.6	27.8	22.4	21.3
Newport County	19,939	9.8	7.3	18.3	22.2	25.4	18.9
Rhode Island	236,667	4.8	7.7	16.5	23.1	29.0	18.9

Source: U.S. Bureau of the Census, 1970

LAND USE

14. Little Compton encompasses a total area of 22.8 square miles, or 14,617 acres. As illustrated by Table 4, almost one-half of this area is undeveloped forest land. Approximately one-third of the area is agricultural or open land, over 50% of which is tilled or tillable intensively farmed cropland. Wetlands account for approximately one-tenth of the town's total area, with urban land comprising a slightly

smaller percentage. Almost 98% of all urban land use in Little Compton is for residential purposes, with the additional 2% split evenly among commercial and public property. Commercial properties in the town include gas stations, restaurants, and retail fish and vegetable stores located along roadways to serve the traveling public away from urban centers. Outdoor recreation and mining and waste disposal each constitutes less than 1% of total ground space in Little Compton.

Table I-5 LAND USE IN LITTLE COMPTON

	Acres	Percent
Outdoor Recreation	116	.8
Agriculture or Open Land	4820	33.0
Forest Land	7024	48.1
Urban Land	1269	8.6
WetLand	1370	9.4
Mining, Waste Disposal	18	.1
TOTAL	14,617	100.0

Source: Compiled with data obtained from Remote Sensing Land Use and Vegetative Cover in Rhode Island by William P. MacConnell, July, 1974

15. Although nearly 60% of the land area in Little Compton is not utilized for any specific purpose, the rural character of the community is considered beneficial by local interests because of its aesthetic quality and its attractiveness to seasonal visitors. The Comprehensive Community Plan for Little Compton has established as a primary goal to provide for orderly development to preserve this rural character by administering proper zoning codes and ordinances, and utilizing open space as a basic element in the pattern of land uses. The plan also recommends, however, that existing economic development be conserved and opportunities for new development be provided with an emphasis on agriculture and year-round commercial fishing. Designation of suitable locations for appropriate seasonal and shore-oriented business development as well as general commercial development to meet the needs of the population is suggested as a means of achieving this goal.

SECTION B

SAKONNET HARBOR

PROFILE OF EXISTING CONDITIONS

16. Much of the seasonal economic activity in Little Compton is centered around Sakonnet Harbor, which is presently the home of a small locally-based fishing fleet which operates principally in seasons of fair weather. Several multi-purpose fishing boats and commercial longline fishing vessels operate out of the harbor year-round, but their use from November to March is severely limited. If fishing boats return to the port under adverse conditions, they usually move up the Sakonnet River to more sheltered locations to unload their catch. Marine commerce now located at Sakonnet Harbor includes trap and gillnet fishing, lobstering (inshore and offshore), swordfishing, and shellfishing. There are four commercial fishing companies presently at the harbor which provide private dockage for commercial craft. Approximately forty-five commercial fishing vessels list Sakonnet Harbor as their home port, (see Table I-6) and another sixteen transient commercial vessels regularly call at the anchorage. One hundred eighteen recreational boats use the harbor as home port, and an estimated 760 transient boats spend an average of one day in port each year.

17. Sakonnet Harbor presently provides 140 moorings and 25 slips for private users, and an additional 30 small sailboats are stored on shore for lack of mooring space and safe mooring conditions. This total of about 195 craft is supplemented by about 50 skiffs, rowboats, and small outboard motor boats. There are two launching ramps located at the harbor, and a daily seasonal average of about 15 motor launches and outboards use these ramps. There has been little change since 1969 in the number of transient recreational craft using the harbor because it

is always filled to capacity and there are no new moorings or slips available. Of the private recreational craft in Sakonnet Harbor, there are approximately 56 power and sail vessels over 20 feet in length, ranging in draft from 1.0 to 5.5 feet. These private recreational vessels have a total value of $524,000. The remaining boats of the recreational fleet are from 12 to 20 feet in length and have drafts between 1.0 and 3.0 feet, and are valued at approximately $128,600.

18. Only commercial fishing rivals recreational boating in significance to the area's economy during the summer months. The primary fishery resource for Sakonnet fishermen is lobster, with thirty-three of the forty-five commercial boats primarily geared for lobstering. The remaining vessels are a mix of power swordfish, trap, seaweed, or charter vessels. Several of the lobster boats are easily rigged for gillnetting and trap fishing when seasonal and cyclical changes in fish population make those forms more profitable. These vessels average approximately 33 feet in length and 3.5 feet in loaded draft. Boats of up to 7-foot draft are able to negotiate the harbor's channel, but only under certain tidal conditions and with a high degree of risk involved.

19. The annual landings exclusive of line and sports fishing were estimated during the 1967-1968 period at about 5,240,000 pounds of fish and 230,000 pounds of lobsters. No official records were kept at that time for Sakonnet Harbor, and these estimates were prepared by local officials. Since that time, records have been maintained by the U.S. Department of Commerce, National Marine Fisheries Service. Catch data for selected years during the period 1972-1978 are shown by major type in Table I-7.

Table I-7 REPORTED COMMERCIAL FISH CATCH, SAKONNET HARBOR

1972 - 1978

Type Catch	1972 pounds	1972 dollars
Fish	1,223,557	192,362
Lobsters	144,059	180,680
Other Shellfish	163,242	28,599
TOTAL	1,530,858	$402,141

Type Catch	1974 pounds	1974 dollars
Fish	1,728,284	228,000
Lobsters	197,303	326,872
Other Shellfish	74,339	13,501
TOTAL	1,999,926	$568,373

Type Catch	1976 pounds	1976 dollars
Fish	1,457,776	281,984
Lobsters	261,500	458,300
Other Shellfish		
TOTAL	1,719,276	$740,284

Type Catch	1978 pounds	1978 dollars
Fish	1,509,445	478,701
Lobsters	336,636	692,498
Other Shellfish	2,380,360 (1)	192,302
TOTAL	4,206,441	$1,363,501

Source: National Marine Fisheries Service
(1) Shell Stock Weight

20. The quantities landed in Table 1-7 are conservative estimates due to the fact that only about 75% of the actual gross haul is reported by fishermen. In order to obtain more accurate catch figures, the Little Compton Harbor Advisory Board undertook a detailed survey throughout 1976, individually interviewing each boat owner and fishing company. The results of this survey are presented in Table I-8.

Table I-8. ESTIMATED CATCH CONFIGURATION, SAKONNET HARBOR

1976

Type of Catch	Weight (lbs.)	Unit Price $/lb.	Value (Dollars)
Lobster	439,467	$1.94	$850,988
Swordfish	27,000	2.35	63,500
Finfish (incl. eels)	1,378,678	.25	344,586
Crabs	2,686	.63	1,686
Charter			12,000
Seaweed	2,000	.10	200
TOTAL	1,849,831 lbs.		$1,272,960

Source: Sakonnet Harbor Advisory Board

21. The findings of this survey indicate that although the total catch estimated by the Sakonnet Harbor Advisory Board exceeded that estimated by National Marine Fisheries Service (NMFS) by only 130,555 lbs., the commercial value of the advisory board's catch exceeded that of NMFS by $532,676. The main reason for the discrepancy in these two values is the difference in the quantity of lobsters reported, with the advisory board's survey exceeding the preceding estimate by 177,967 lbs. At a unit price of $1.94 per pound, this additional amount of lobster accounts for $345,256 or 65% of the difference in commercial value. A review of the Sakonnet Harbor Advisory Board's survey results by NMFS indicated that the figures presented in Table I-8 are more accurate than what they themselves publish.

22. As the data in Table I-7 indicates, a substantial decrease in catch has been realized in comparison with the reported catch levels of 1967-1968. This decline was the result of a combination of factors, but was primarily due to the very severe depletion of fish populations by efficient, modernized foreign trawlers equipped with deep water gear. While the volume of total catch has remained relatively stable since 1971, the steadily increasing unit price resulting from an increased demand for high protein foods, increased cost of meat products, and the scarcity of food staples abroad has prevented a decrease in the commercial value of the landed catch.

23. Also contributing to the decline in total landings at Sakonnet Harbor has been the elimination of ocean quahogging from Sakonnet since 1971. During the period from 1969 to 1971, quahog landings averaged about 46,000 bushels or 460,000 pounds of meat per year. The unavailability of these resources at Sakonnet Harbor acquired added significance due to the dramatic increase in demand for ocean quahogs by seafood processors in Rhode Island and other neighboring states. However, the availability of surf clams in waters in close proximity to Sakonnet Point has somewhat offset the economic loss associated with the

decline in quahogging. Landings of surf clams totalled over two million pounds (shell stock weight) valued at $188,780 in 1978. Local fishermen have expressed their belief that at the time this supply is exhausted, the quahog resource will be somewhat replenished.

24. Sakonnet Harbor provides a setting for a significant portion of Little Compton's total employment. A recent census of fishermen operating out of the harbor indicates that fishing and directly related shore activities offer employment for approximately 155 people, of which 81 are Little Compton residents. As previously mentioned, the Rhode Island Department of Economic Development listed total covered employment for Little Compton (i.e. actual job offerings in the town) as 175 in 1977. Of the town's total 1978 workforce estimated by the Rhode Island Office of Employment Security at 827, 10% is at least partially dependent on the fishing industry at Sakonnet for its livelihood.

FUTURE CONDITIONS WITHOUT PROJECT

25. Without the implementation of improvements at Sakonnet Harbor to provide protection of the vessels anchored there, little change in the status quo could be expected. The size of the commercial fishing fleet has remained static over the last ten years, due to limits on expansion space and exposure to the elements. There is little doubt that this condition will continue given the present limited facilities and despite the general trends toward improved opportunities in ocean fisheries. Over the long run, it is likely that the condition of the fishing industry in Little Compton will deteriorate, due to an inability to compete with more efficient operations out of neighboring ports.

26. The larger, well established fishing ports at Newport and Galilee presently land about 95% of the states total catch, and these ports should continue to dominate future fishing commerce in Rhode Island. However, probable expansion of the fishing industry due to replenishment of the resource under the 200 mile limit on territorial waters should allow small harbors to prosper from increased catches as well. This possibility would be precluded at Sakonnet Harbor if none of the considered improvement schemes were adopted. The harbor will continue to remain almost useless during the period 15 November to 15 February, and the predominant form of fishing will continue to be the floating fish trap method. Fifty years ago, fish traps dominated Rhode Island commercial fisheries in the same manner that trawlers do today.(1) Since 1967, floating traps have accounted for 10% or less of all Rhode Island landings by weight and dollar value. In 1976, however, fully 97% of the finfish landed by Sakonnet fishermen were caught by the floating trap method. Floating fish traps are designed to intercept

(1)Olsen, Stephen B. and Stevenson, David K., Commercial Marine Fish and Fisheries of Rhode Island, University of Rhode Island Marine Technical Report 34,1975.

migrating schools of fish, particularly scup, by setting what is essentially a net trap suspended by floats and anchored to the bottom. This activity is limited to a designated season when schools are moving, primarily during the good weather between April and October. During the period 1969-1971, 79% of the states entire floating trap catch was landed in the single month of May. A large portion of this catch was landed at Sakonnet Harbor, located in close proximity to many of the state's designated floating fish trap grounds. This type of fishing is conducive to present conditions at Sakonnet because it can be accomplished in small to medium-sized open boats in the 30-to-35 foot length range, which can easily navigate the harbors limited anchorage area.

27. Because conditions at Sakonnet Harbor presently discourage the modernization of the fishing fleet to include the more efficient and productive trawlers capable of gillnetting and longlining on a year-round basis, landings at that port cannot be expected to increase significantly in the absence of physical improvements. Only the twelve boats currently anchored at Sakonnet with the capability of operating on a year-round basis would be expected to continue doing so in the future. Similarly, lobstering would continue on a scale approximately equivalent to that which exists today. The trend toward offshore lobstering would continue, with Sakonnet's lobstermen either operating out of alternative ports during winter months or hauling their vessel ashore until spring.

PROBLEMS AND NEEDS OF THE STUDY AREA

28. Sakonnet Harbor's exposure and extreme southerly location have made it susceptible over the years to damage by northerly winds and waves. This exposure has prevented any substantive expansion of harbor facilities. The harbor, therefore, historically has served only a limited role in the area's economy. The future of the harbor clearly depends on implementation of improvements to provide protection from extreme weather conditions and the dominant winds which enter from the north. Increased markets for New England lobster and ocean quahogs provide an opportunity for Sakonnet Harbor to assume a more significant role in the regional economy if the desired protection is provided.

29. The most important and significant improvement required at Sakonnet Harbor is the provision of a breakwater across the northern approach of existing anchorage. With this improvement, Sakonnet Harbor faces a promising future in the expanding commercial fishing industry. Moreover, the existing recreational fleet would also enjoy a measure of protection from summer storms, and the anchorage would take on a new role as a harbor of refuge for boats caught offshore in severe storms.

30. Clearly the economic benefits resulting from the provision of a new breakwater across the northern approach of Sakonnet Harbor would accrue to the commercial fishing fleet. The breakwater will immediately allow the existing fleet to operate on a year-round basis, an absolute requirement for a viable commercial fishery. Within a short period of

time the commercial operators will be encouraged by the protection afforded by the breakwater to modernize and upgrade their gear and equipment, and some will even purchase new boats. Also within a few years after completion of the breakwater, new and larger offshore boats could be added to the existing fleet, thereby producing significant economic benefits to the commercial fleet.

31. Reflecting the needs described above, the Little Compton Town Council and its Harbor Advisory Board have requested the following improvements for Sakonnet Harbor.

- A rubble mound breakwater, to protect the harbor from heavy seas and floating ice generated by north and northwest winds.

- An access channel of sufficient length, width, an depth to serve the anticipated addition of new multipurpose fishing vessels.

SECTION C

PLANNING OBJECTIVES AND CONSTRAINTS

NATIONAL OBJECTIVES

32. Planning for channel improvements in Sakonnet Harbor is based in part on national objectives of economic development and enhancement of environmental quality. Section 103 of the Water Resources Planning Act of 1965 directed the National Water Resources Council to establish principals and standards for planning Federal and Federally-aided water resource projects. In 1973, the Council published Principles and Standards for Planning Water and Related Land Resources which provide the broad policy framework for planning activities. The Standards provide for uniformity and consistency in comparing, measuring and judging the beneficial and adverse effects of alternative water resource improvement projects. The purpose of the Principles and Standards is to promote the quality of life by planning for the attainment of the following objectives:

> To enhance national development by increasing the value of the nation's output of goods and services and improving national economic efficiency.
>
> To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural resources, cultural resources and ecological systems.

33. These are termed National Economic Development (NED) and Environmental Quality (EQ) objectives. The NED and EQ objectives were fully considered in developing and evaluating the alternative improvement plans.

PLANNING CONSTRAINTS

34. Planning constraints are those items which specify limitations that are used to direct plan formulation and restrict or minimize adverse impacts. This study has identified, through consultations with local interests, one issue which may be categorized as a constraint.

35. The town of Little Compton, being predominantly residential, does not have a road network which would be capable of accommodating large numbers of heavy construction equipment. Therefore, to minimize onshore vehicular traffic, breakwater construction will be entirely offshore.

36. Although only one constraint has been identified, two concerns have been raised during the study and all attempts will be made to meet the steps necessary to comply with these identified concerns. The two concerns identified are discussed in the following paragraphs.

37. As stated previously, Sakonnet Harbor is heavily utilized during the summer months by recreational boat traffic. Any activities which may interfere with access to the harbor and its onshore support facilities would be considered disruptive. Therefore, to insure against the occurrence of any major disruptions, dredging activities will attempt to avoid the time period from 1 April to 15 September.

38. The second concern identified would be to minimize the impacts the breakwater would have on tidal currents within the harbor. As the tidal currents aid in maintaining the water quality within the harbor any structure which would reduce those currents may have a significant environmental impact.

PLANNING OBJECTIVES

39. Planning objectives for this study were established after carefully analyzing the identified constraint no concerns regarding the use of water and related land resources in the study area. These objectives are developed specifically for the given study area and will be utilized as a guide in the formulation of alternative plans.

40. Based on the discussions of problems, needs and opportunities, two planning objectives have been identified as guidelines to meet the area needs and study objectives.

- Contribute to commercial navigation in Sakonnet Harbor during the 1980-2030 period of analysis.

- Contribute to the year round utilization of Sakonnet Harbor for commercial vessels during the 1980-2030 period of analysis.

SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

FORMULATION, ASSESSMENT AND EVALUATION OF
DETAILED PLANS

APPENDIX 2

Prepared by the
Department of the Army
Corps of Engineers
New England Division

FORMULATION, ASSESSMENT AND EVALUATION OF DETAILED PLANS

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SECTION A

FORMULATION, ASSESSMENT AND EVALUATION OF DETAILED PLANS

1. The formulation of a plan of improvement for Sakonnet Harbor has followed the procedures of the Water Resouces Council Principles and Standards. Local needs and desires were identified and project specific planning objectives and constraints were established. These planning objectives and constraints were considered in the formulation of detailed plans, as were the national objectives of National Economic Development (NED) and Environmental Quality (EQ).

Formulation and Evaluation Criteria

2. Detailed technical, economic, and environmental criteria were applied in the formulation and evaluation of the alternative plans. These criteria reflect quantitative measures of the plan performance in relation to the national and local planning constraints. These criteria, which are described below, are utilized in the System of Accounts to evaluate the three alternative detailed plans.

Technical Criteria

3. The technical criteria are as follows:

- The selected plan should allow for year-round utilization of Sakonnet Harbor by the commercial fishing fleet. The breakwater should be located such that the vessels and attendent facilities can be protected at a reasonable cost.

- Channel dimensions (length, width and depth) should be adequate for the types of craft expected to use the harbor.

- Provide adequate separation from the existing shoreline such that the breakwater will not have an impact on water quality within the harbor.

Economic Criteria

4. The economic criteria are as follows:

   - maximize net benefits (project benefits minus project costs)
   - maximize net benefits to the town of Little Compton

Environmental, Social, and Cultural Criteria

5. The environmental, social, and cultural criteria are as follows:

   - minimize volume of dredged material in order to reduce problems relating to the disposal of dredged materials.

   - minimize impacts to water quality within the harbor.

   - provide improvements which will be compatible with present activities within the harbor.

   - maximize safety and ease of navigation to commercial and recreational craft.

   - maximize cultural and aesthetic value to the harbor.

SECTION B

Possible Solutions

6. Possible solutions to the problem of developing a year-round fishing capability for Sakonnet Harbor commercial fishermen include utilizing existing condition (no improvement option) or developing new facilities.

No Improvement Option

7. The development of an efficient cost effective year-round fishing capability at Sakonnet Harbor without the Federal project would be extremely unlikely. With no Federal project there would be essentially two options that could be undertaken without dredging and the breakwater construction.

8. The first would be to make use of the harbor under its present condition. During the winter months, ice floes and heavy seas accompanied by high winds making navigation within the harbor hazardous would effectively negate any opportunities to establish a winter fleet. Use of the harbor therefore, would be limited to fair weather months. The other possibility would be to have the Sakonnet fishing fleet shift its base of operations to an existing well sheltered harbor during the winter months.

9. A survey of the harbors within close proximity to Little Compton reveals that the existing facilities within these harbors are being utilized to their maximum design capabilities. Identified in this analysis are the ports of Newport and Galilee to the west of Sakonnet Harbor, New Bedford and Westport to the east, and Tiverton to the north. These harbors are shown in Figure 2-1. Facility inventories, based on 1976 data for each harbor are enumerated in Tables 2-1, through 2-5.

10. Newport, Rhode Island has been the subject of a Federal Navigation Improvement Study, the selected plan consisted of a channel 150 feet wide, 15 feet deep and approximately 1300′ long. It entailed the dredging of about 18,000 cubic yards of silt and clay and disposal of same. The project was placed on the deferred category list due to the lack of an adequate disposal site for dredged materials.

11. A Federal Navigation Improvement was completed in Galilee, Rhode Island in 1976, to allow for further development of the commercial fishing industry. The project involved widening and extending the Federal east channel. Presently, no additional capacity now exists in Galilee for further expansion.

12. Tiverton, Rhode Island is primarily a recreational port, which does not have the required onshore facilities to support a year-round additi... to their fleet.

13. Westport, Massachusetts was the subject of a small Navigation Project Study which consisted of constructing a jetty from Westport Point to Half Mile Rock and dredging a channel through the entrance area. The study h... been deferred as the local interests have been unable to meet local cooperation requirements and did not concur with the proposed location of the jetty.

14. New Bedford and Fairhaven Harbor, Massachusetts was also the subject of a Small Navigation project in which the selected plan of improvement included the deepening and widening of the existing Federal channel, and the extension of the channel northerly for a distance of 600 feet. Dredging in New Bedford-Fairhaven has been delayed for years because of problems in locating a suitable disposal site. The improvement work proposed for the site has been dropped since 1971 due to the lack of an economically feasible disposal site.

Table 2-1

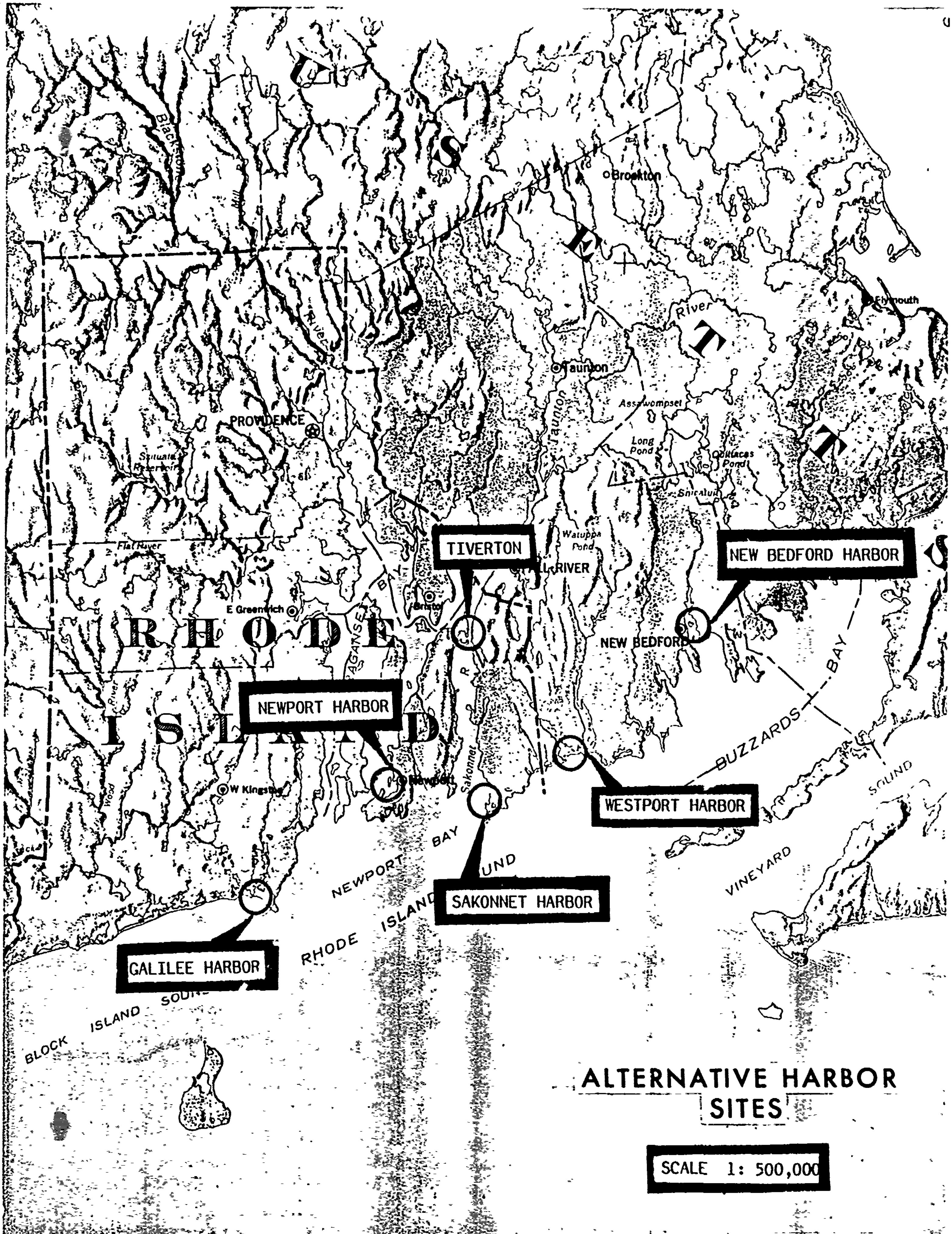
Facility Inventory for Newport Harbor, Rhode Island

a. 2 yacht clubs
b. 9 repair facilities
c. 8 facilities dealing with services and supplies
d. 7 offering moorings and dockside facilities
e. 2 businesses offering year-round facilities
f. 4 railroads: 1-45', 10 ton; 2-1100', 400T; 1-500 Ton
g. 3 storage facilities
h. 2 travelifts
i. 2 cranes: 8 Ton and 1-1/2 Ton
j. 1 public ramp

Table 2-2

Facility Inventory for Galilee Harbor, Rhode Island

a. 1 yacht club
b. 3 dealerships for repairs
c. 3 dealerships for miscellaneous services & supplies
d. 4 mooring and dockside facilities
e. 1 crane - 10 Ton
f. 1 public ramp, slips and miscellaneous services



ALTERNATIVE HARBOR SITES

FIGURE 2-1

Table 2-3

Facility Inventory for Westport Harbor, Massachusetts

a. 2 railroads 30 Ton and 40 Ton
b. 2 cranes 10 Ton & 20 Ton
c. 3 facilities for mooring, dockside services & repairs
d. 1 yacht club
e. 1 small public ramp
f. 1 year-round facility with services

Table 2-4

Facility Inventory for New Bedford, Massachusetts

a. 3 public ramps
b. 3 travelifts: 6T; 20T; 35 Ton
c. 2 cranes: 5T, 25 Ton
d. 3 railroads: 50 Ton; 100′; 100′, 450 Ton
e. 3 businesses with year-round facilities
f. 6 miscellaneous services and supplies
g. 4 with moorings and dockside facilities

Table 2-5

Facility Inventory for Tiverton, Rhode Island

a. 1 yacht club
b. 1 repair service
c. 3 miscellaneous services & supplies
d. 2 mooring & dockside facilities
e. 1 travelift 30′ 6 Tons
f. 1 railroad 55′, 17 Tons

15. Based on the above analysis, a nonstructural alternative to allow expanded fishing activity by Sakonnet fishermen has been eliminated from further consideration. The expansion capacity and capability in nearby ports is considered inadequate and the situation cannot reasonably be expected to change in the near future.

Develop New Facilities

16. The development of new facilities in Sakonnet Harbor is considered to be the most satisfactory means of meeting the needs of the town of Little Compton.

Plan Formulation Rationale

17. In order to develop detailed improvement plans, the following five steps were undertaken:

Identify Characteristics of the Existing and Project Commercial Fishing Fleet

18. The numbers, sizes and types of the boats utilizing and expected to utilize the harbor were estimated using procedures set forth in Appendix 5.

Establish Required Breakwater Dimensions

19. Three separate breakwater configurations were developed for detailed study. These have been designated as Detailed Plans A, B and C. These three plans are analyzed in detail in the following section.

Determine Alternative Breakwater Locations

20. Two separate alignments were developed for detailed study with one alignment considered for Plans A and B, and a second alignment for Plan C. Subsequent paragraphs within this appendix analyzed and determined that the alignment selected for Plans A and B was preferable over the alignment for Plan C.

Establish Required Channel Depths and Widths

21. Alternative channel depths and widths were analyzed to determine the most cost effective dimensions based on the type of craft expected to use Sakonnet Harbor. A channel depth of 10 feet mlw and a channel width of 110 feet were found to be the most desirable channel dimensions. The determination of channel dimensions is explained in detail in Appendix 5.

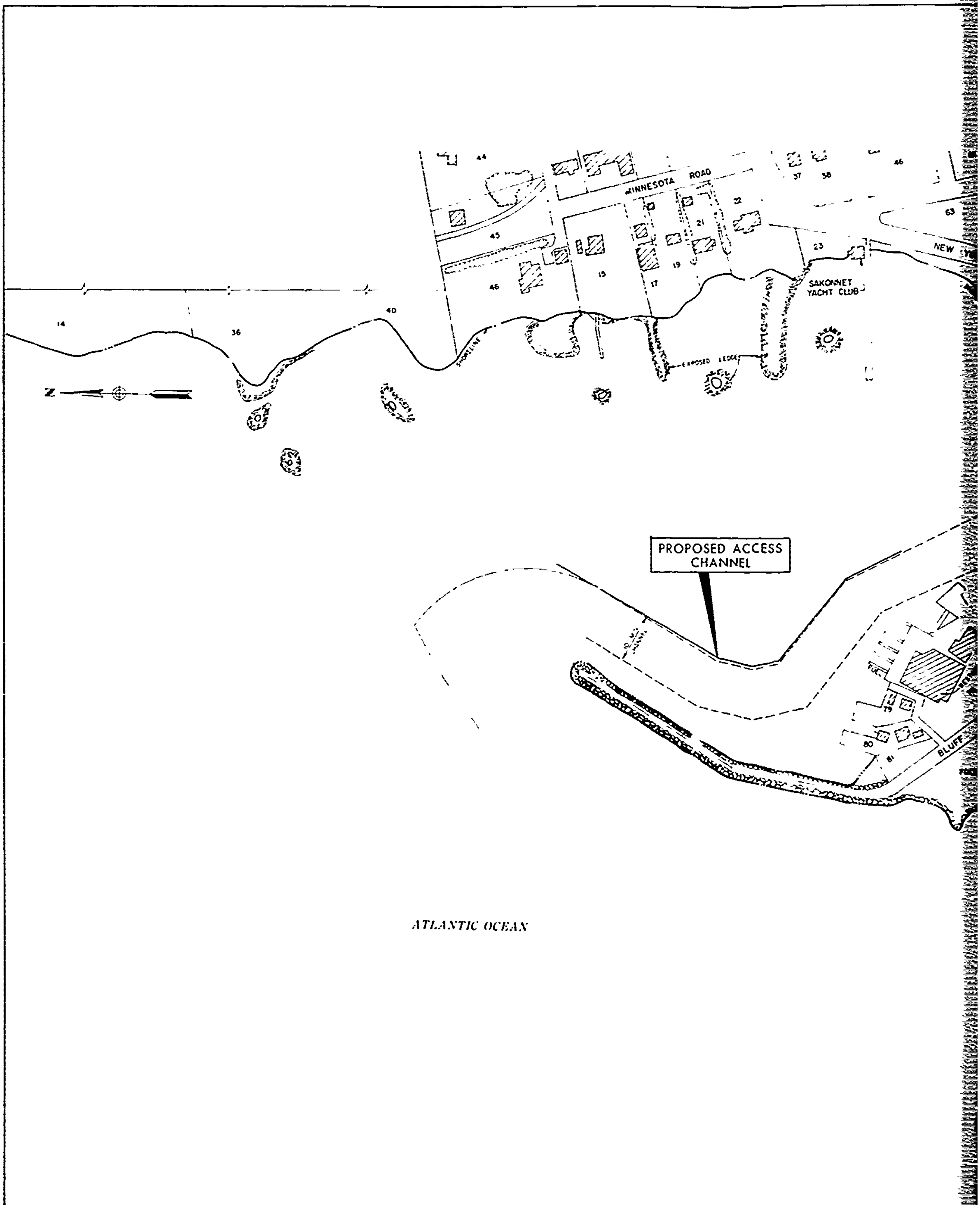
Determine Alternative Channel Locations.

22. The channel location was developed in recognition of the existing and proposed facilities within Sakonnet Harbor. The channel parallels the existing west harbor breakwater and will provide access to the existing and proposed commercial facilities.

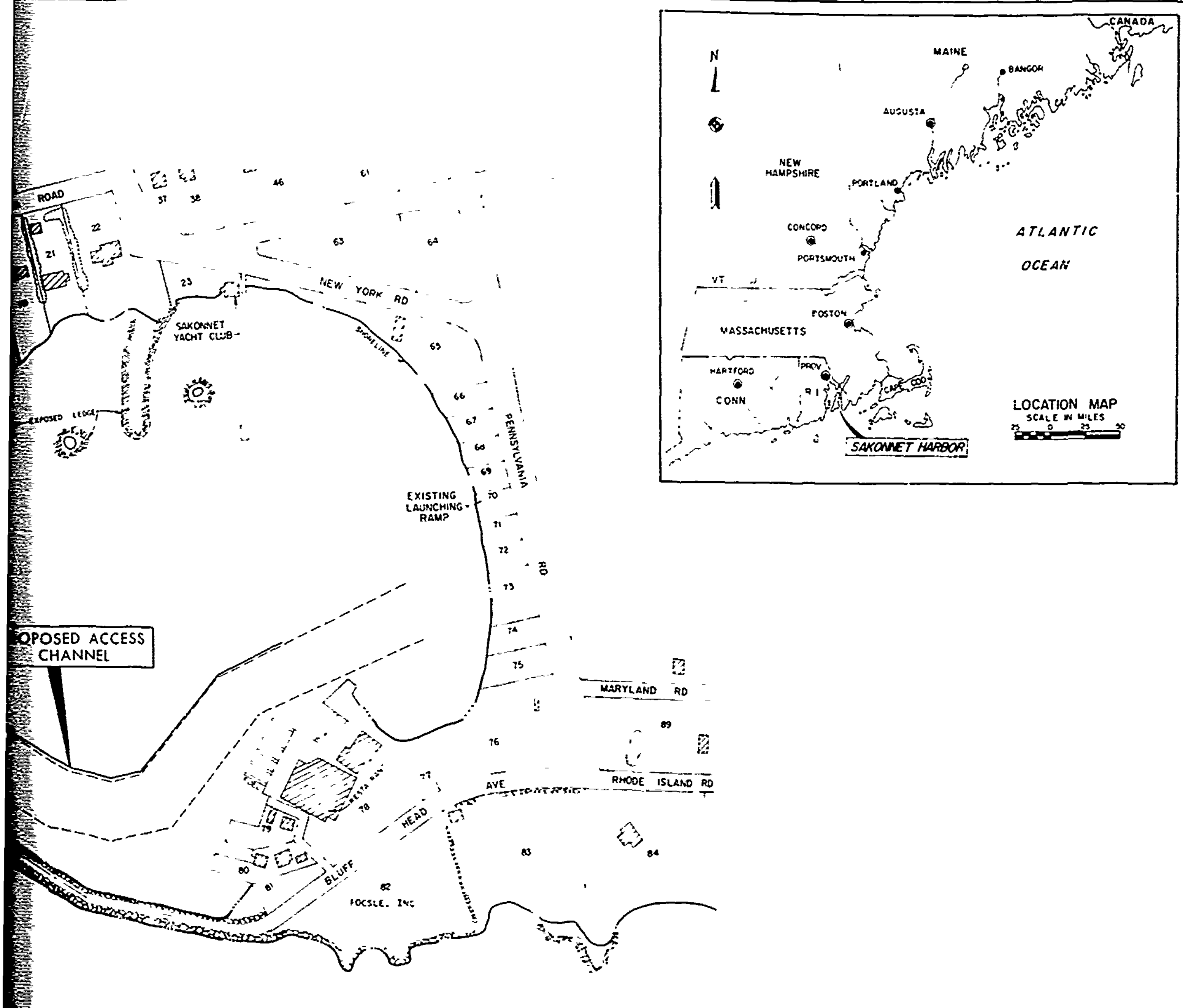
Description and Evaluation of Detailed Plans

23. The development of detailed plans was predicated on the aforementioned plan formulation rationale. As the previous section indicated, preliminary studies determined that only one channel alignment warranted detailed study. Based upon that determination and recognizing that the channel is an integral component of the three proposed plans of improvement, its impacts will be described separately. This will allow the reviewer to assess the proposed channel alignment based on its own merits and avoid the necessity of repeating the same data for each of the alternative plans of improvement as they relate to the breakwater.

24. As Figure 2-2 indicates, the access channel would extend from the northern end of the existing west harbor breakwater and proceed in a southerly direction for a total leng h of 1,155 feet. The channel would be 110 feet wide by 10 feet deep at mlw.



MINNESOTA ROAD
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
NEW
BLUFF
PROPOSED ACCESS CHANNEL
ATLANTIC OCEAN
Z



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LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

PROPOSED ACCESS CHANNEL

DATE SEPTEMBER 1980 SCALE 1" =100'

FIGURE 2-2

25. The water depth in the first 200 feet of channel varies from a maximum of 18.0 feet mean low water to a minimum depth of 10.0 feet mean low water. Therefore, dredging will not be required in this section of the channel. The depth of water in the remainder of the channel varies from a maximum of 10.0 feet mean low water to a minimum of 8.0 feet mean low water. The shallowest section of the channel is located at a point directly opposite the site of the proposed berthing facilities which are to be utilized by the offshore lobster boats. The maximum dredging effort will require the removal of a three-foot cut, including a one-foot overdepth in earth and a two-foot overdepth in rock, and is restricted to the latter portions of the channel.

26. Channel construction requires the removal of 8,000 cubic yards of material. Cost estimates for construction of the channel are located in Appendix 4.

27. Channel dredging, although limited to the fall and winter months would cause some delay to existing traffic within the harbor. However, as the construction effort is expected to last no more than 30 days, major conflicts are not anticipated.

28. The following section deals with a detailed description of the three alternative breakwaters.

Plan A

29. Plan A shown on Figure 2-3 would provide for a 750-foot rubblemound breakwater on a bearing of south 62° west running from a point approximately 100 feet offshore from a plot of land, numbered 36 on the town of Little Compton plot plan. The structure would be at an elevation of 8 feet above mean low water.

30. Construction of the breakwater would require 33,730 tons of core and blanket stone, 16,200 tons of bedding stone and 14,340 tons of armor stone.

31. Cost estimates for Plan A are located in Appendix 4 and anticipated benefits are located in Appendix 5. A summary of the project costs are shown in Table 2-6.

32. The 750-foot breakwater, as designed, would provide the greatest overall protection from adverse wind and ice conditions. However, as the Hydrogrpahic Analysis presented in Appendix 4 indicates, this structure would have the greatest impact on flushing action within the harbor. As flushing action impacts directly on water quality, implementing this plan may result in degradation of overall water quality within the harbor. It should be noted however, that the hydrographic analysis concluded that wind driven currents are an order of magnitude higher than the tidal currents.

Table 2-6
PLAN A

SUMMARY OF PROJECT COSTS

Total First Cost

Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,790,000
Contingencies (15%)	268,500
Total Construction Cost	$2,058,500
Engineering and Design	123,500
Supervision and Administration	164,700
Total Estimated First Cost	$2,482,700
Annual Cost	
Interest and Amortization (7-3/8%)	$188,500
Breakwater Maintenance	20,000
Channel Maintenance	2,400
Total Annual Cost	$210,900

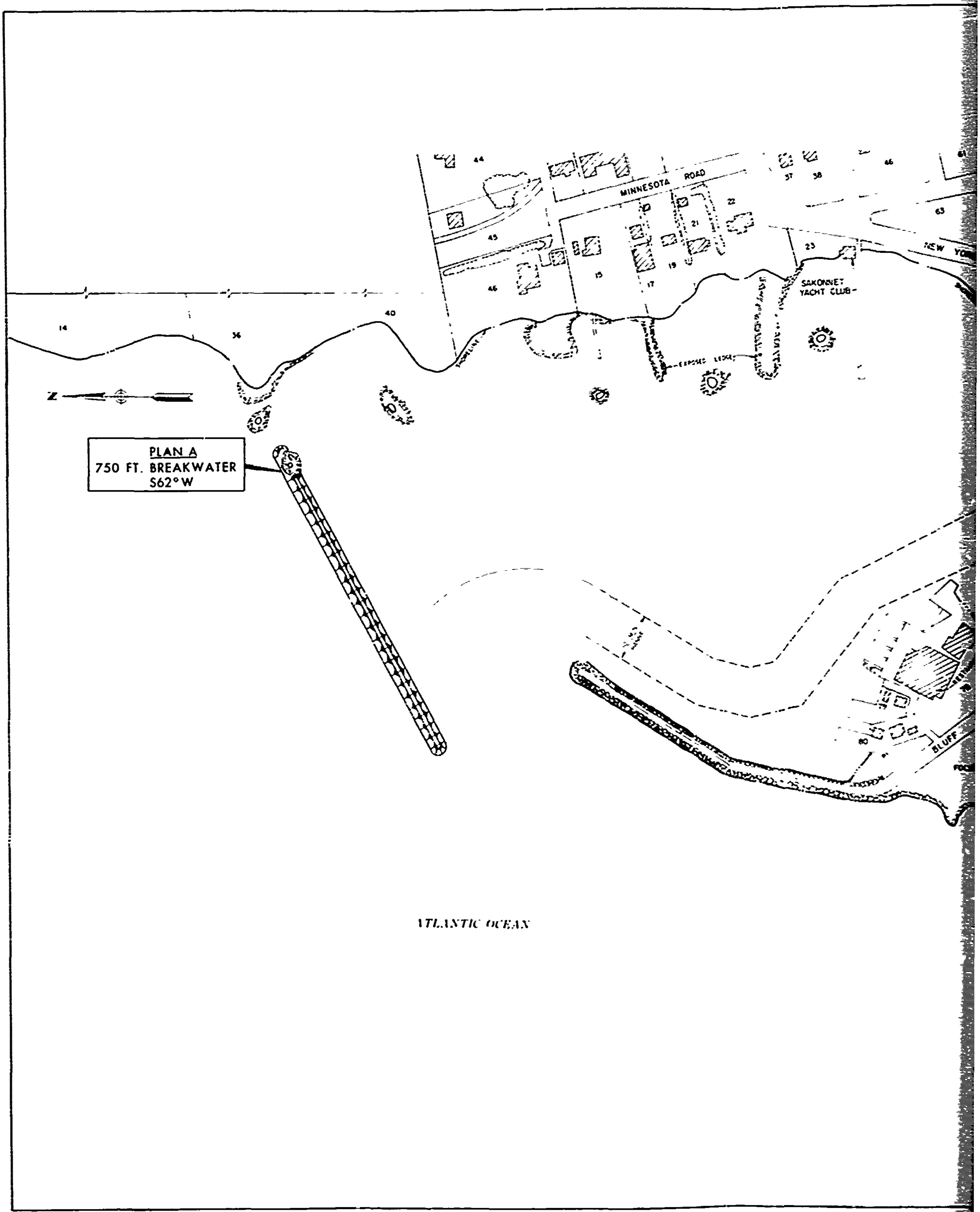
PLAN B

33. Plan B, as shown in Figure 2-4, would provide for a 500-foot rubble-mound breakwater on a bearing of south 62° west running from a point approximately 450 feet offshore from a plot of land numbered 36 on the town of Little Compton plot plan. The breakwater would be at an elevation of 8 feet above mean low water.

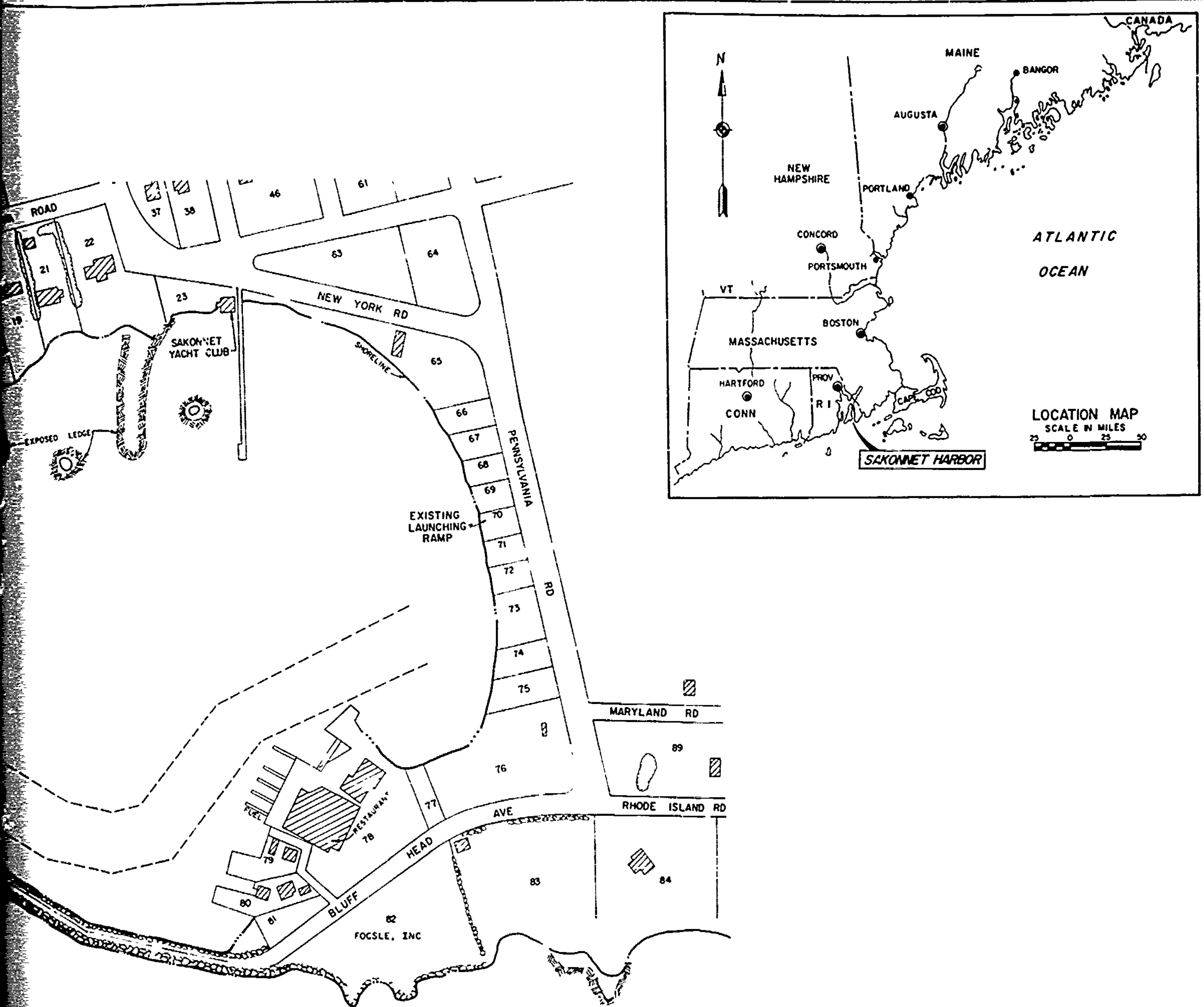
34. The breakwater would require 27,375 tons of core and blanket stone, 11,712 tons of bedding stone, and 9,351 tons of armor stone.

35. Cost estimates for Plan B are located in Appendix 4 and anticipated benefits are located in Appendix 5. A summary of the project costs are shown in Table 2-7.

36. The 500-foot breakwater, as designed, would provide optimal protection. In addition, the Hydrographic Analysis concluded that reducing the length of the structure by 250 feet would allow for a 50 percent increae in the flow of water. Although tidal currents are not considered overly significant for harbor flushing, it would nevertheless have less of an impact on water quality within the harbor, and Plan B is therefore considered more environmentally sound than Plan A.



MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
PLAN A
750 FT. BREAKWATER
S62° W
BLUFF
ATLANTIC OCEAN



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WATER RESOURCES IMPROVEMENT STUDY

PLAN A

DATE SEPTEMBER 1980 | SCALE 1"=100

FIGURE 2-3

2

TABLE 2-7

PLAN B

SUMMARY OF PROJECT COSTS

Total First Cost

Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,277,000
Contingencies (15%)	192,000
Total Construction Cost	$1,469,000
Engineering and Design	85,000
Supervision and Administration	110,000
Total Estimated First Cost	$1,800,000

Annual Cost

Interest and Amortization (7-3/8%)	$136,600
Breakwater Maintenance	15,000
Channel Maintenance	2,400
Total Annual Cost	$154,000

PLAN C

37. Plan C, as shown in Figure 2-5, would provide for a 600-foot rubble mound breakwater on a bearing of south 42° west beginning at a point coincident with the southwesterly terminus of the breakwater in Plans A and B. The breakwater would be at an elevation of 8 feet above mean low water.

38. The breakwater would require 37,205 tons of core and blanket stone, 14,964 tons of bedding stone, and 10,052 tons of armor stone.

39. Cost estimates for Plan C are located in Appendix 4 and anticipated benefits are located in Appendix 5. A summary of the project costs are shown in Table 2-8.

40. The 600-foot breakwater as designed, would provide the least protection from wind generated waves by virtue of the increased harbor openings to the east and west. This structure however, would permit approximately 85 percent greater flow action over that of Plan A and approximately 35 percent over Plan B.

Table 2-8

PLAN C

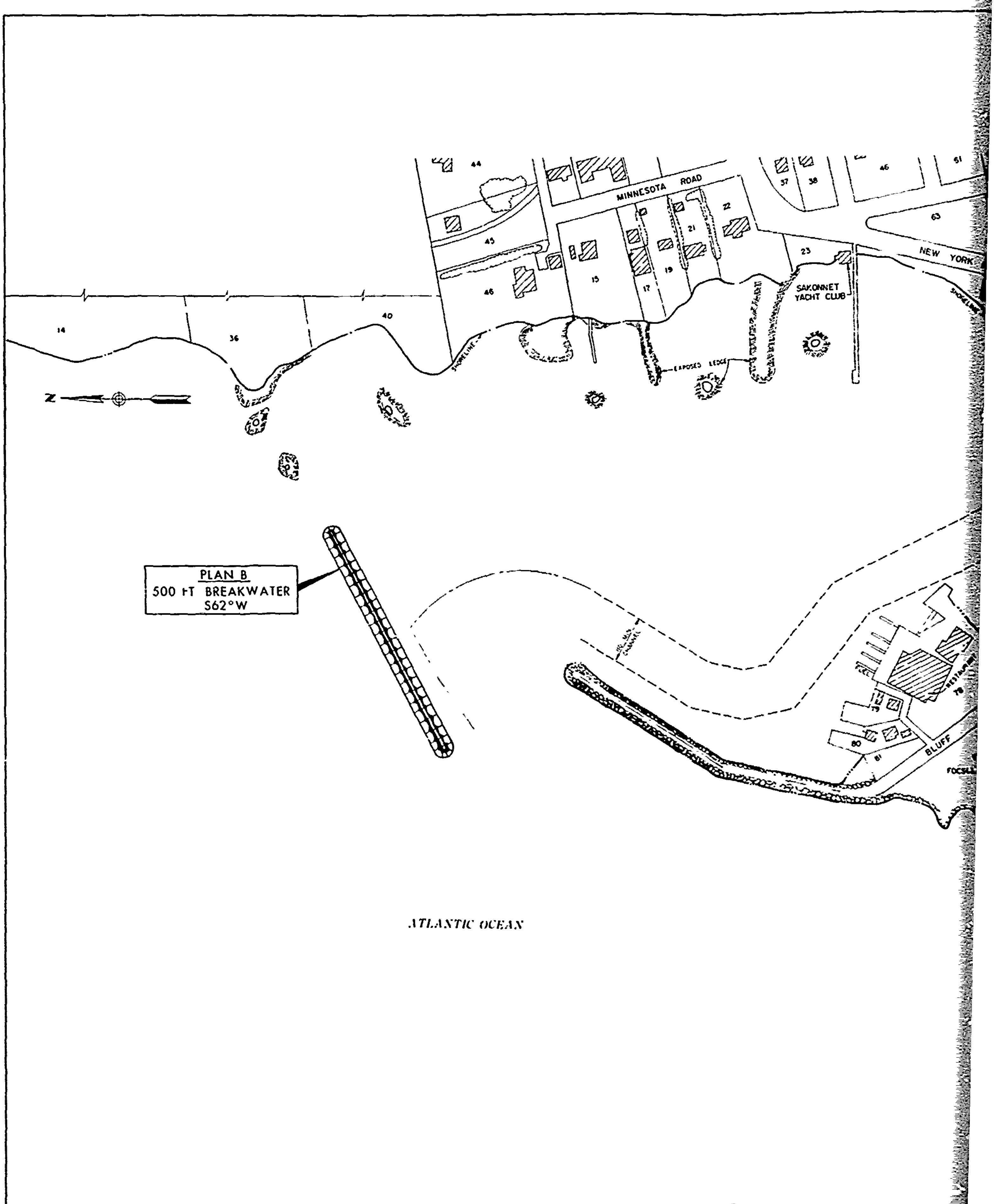
SUMMARY OF PROJECT COSTS

Total First Cost

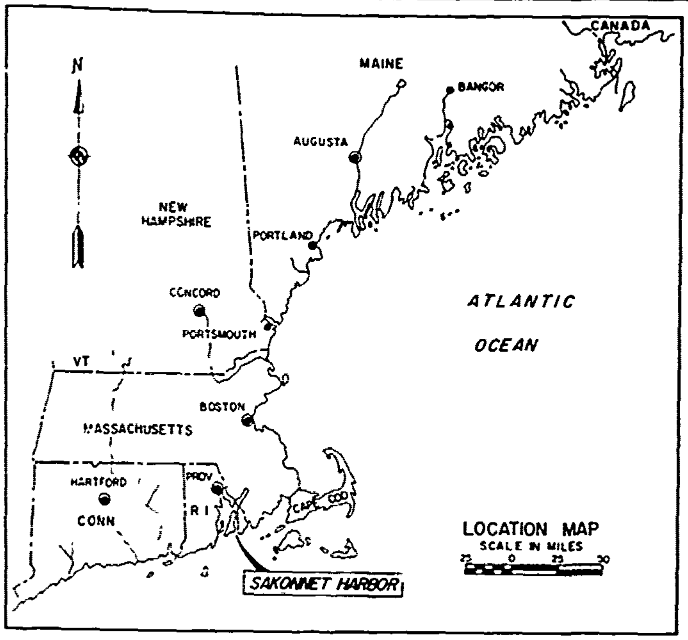
Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,510,000
Contingencies (15%)	226,500
Total Construction Cost	$1,736,500
Engineering and Design	104,200
Supervision and Administration	138,900
Total Estimated First Cost	$2,115,600

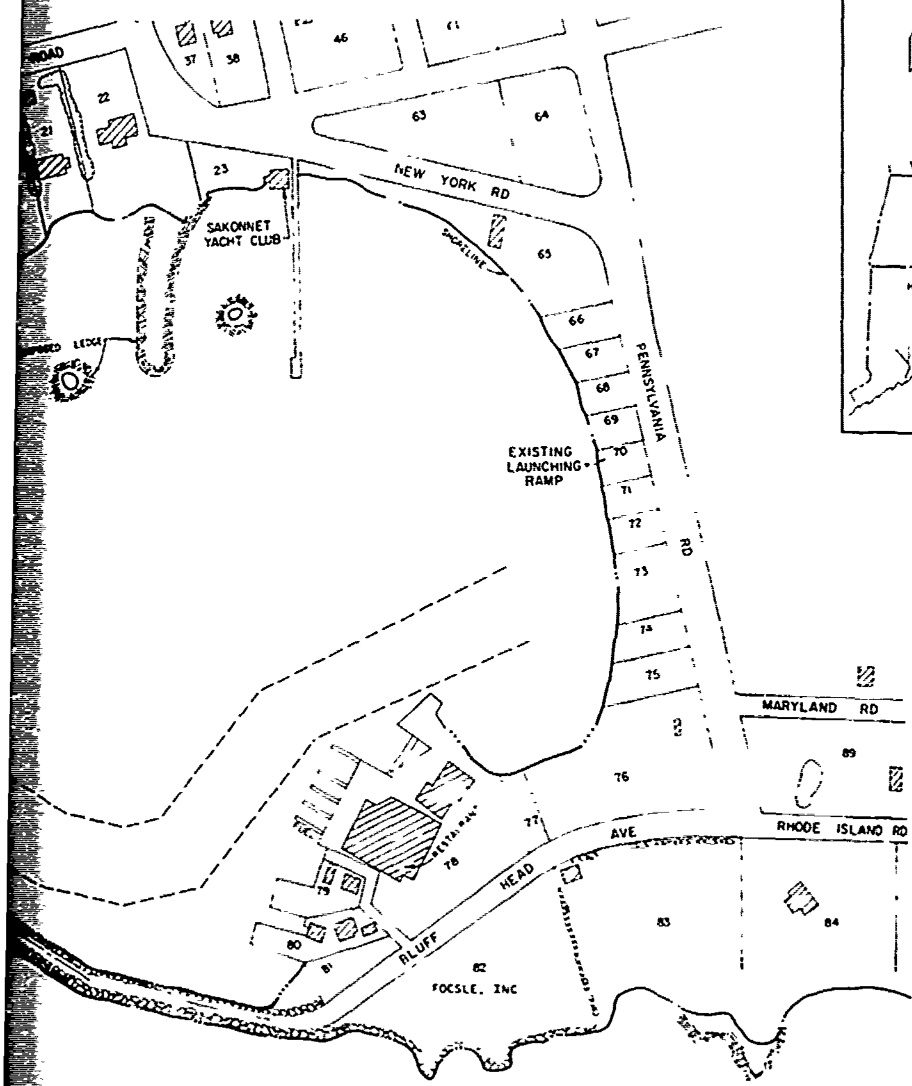
Annual Cost

Interest and Amortization (7-3/8%)	$160,600
Breakwater Maintenance	17,000
Channel Maintenance	2,400
Total Annual Cost	$180,000



MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
PLAN B
500 FT BREAKWATER
S62°W
BLUFF
ATLANTIC OCEAN





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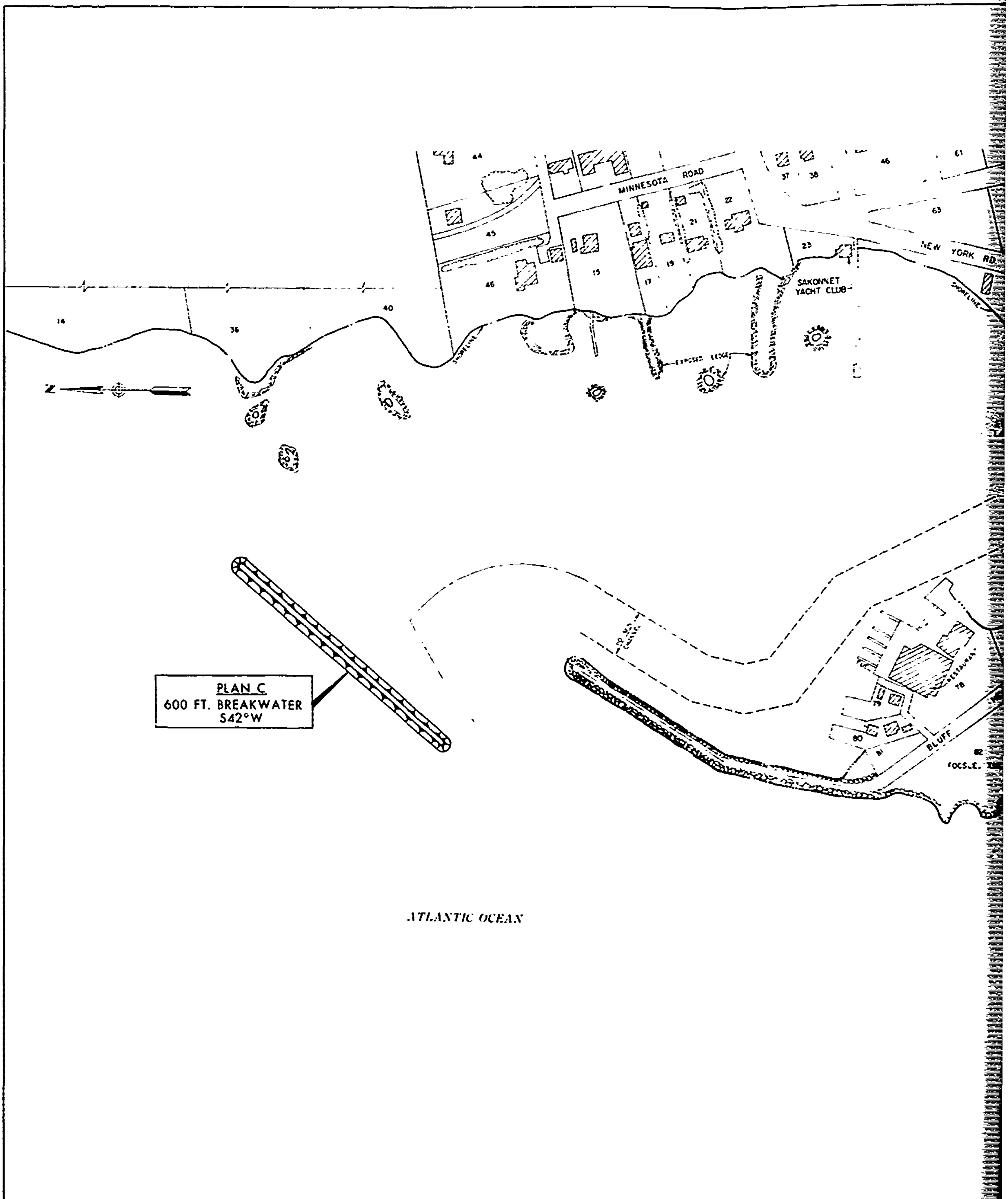
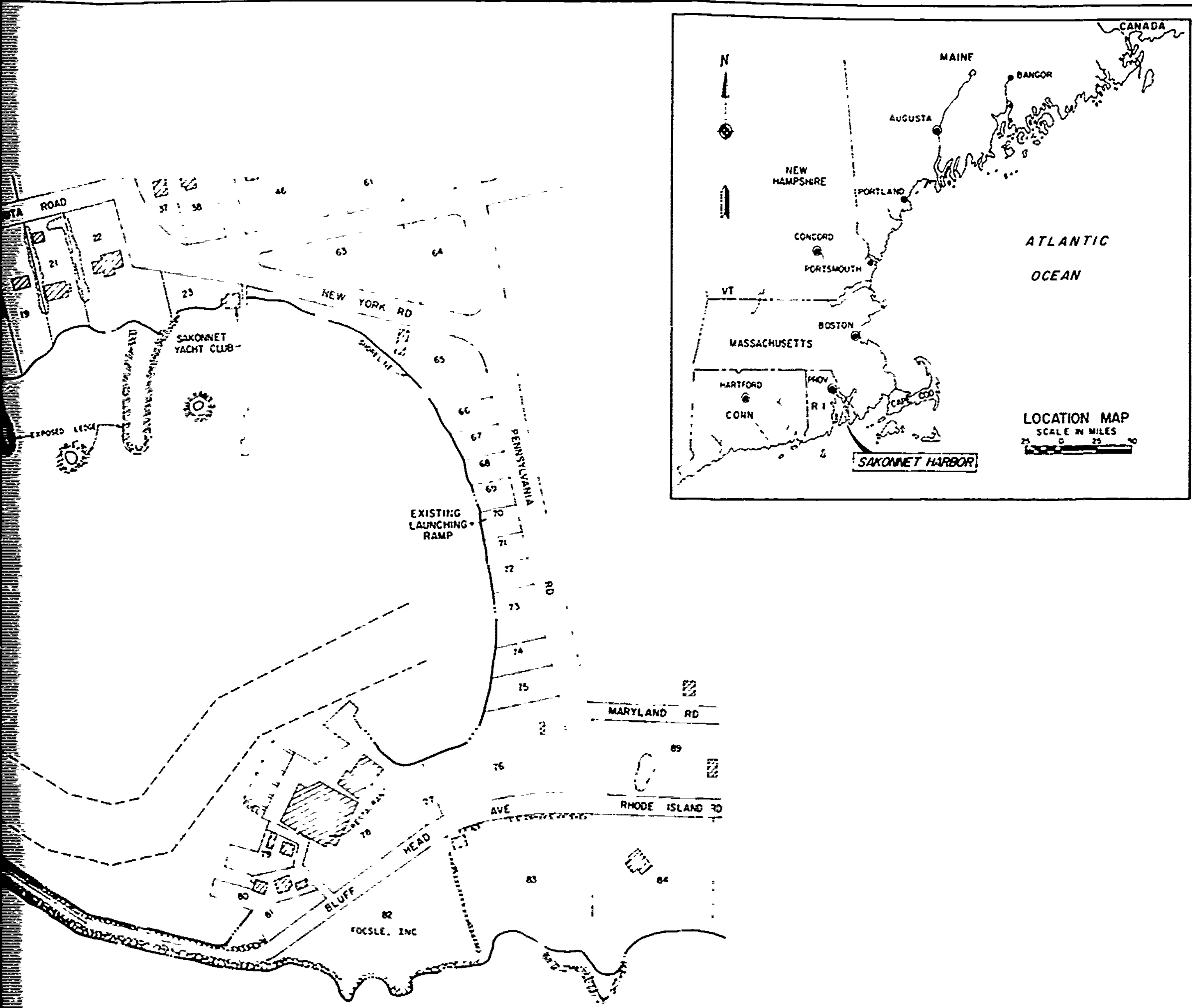
PLAN B

DATE SEPTEMBER 1990 | SCALE 1"=100

FIGURE 2-4



MINNESOTA ROAD
NEW YORK RD.
SAKONNET YACHT CLUB
SHORELINE
EXPOSED LEDGE
BLUFF
PLAN C
600 FT. BREAKWATER
S42°W
ATLANTIC OCEAN



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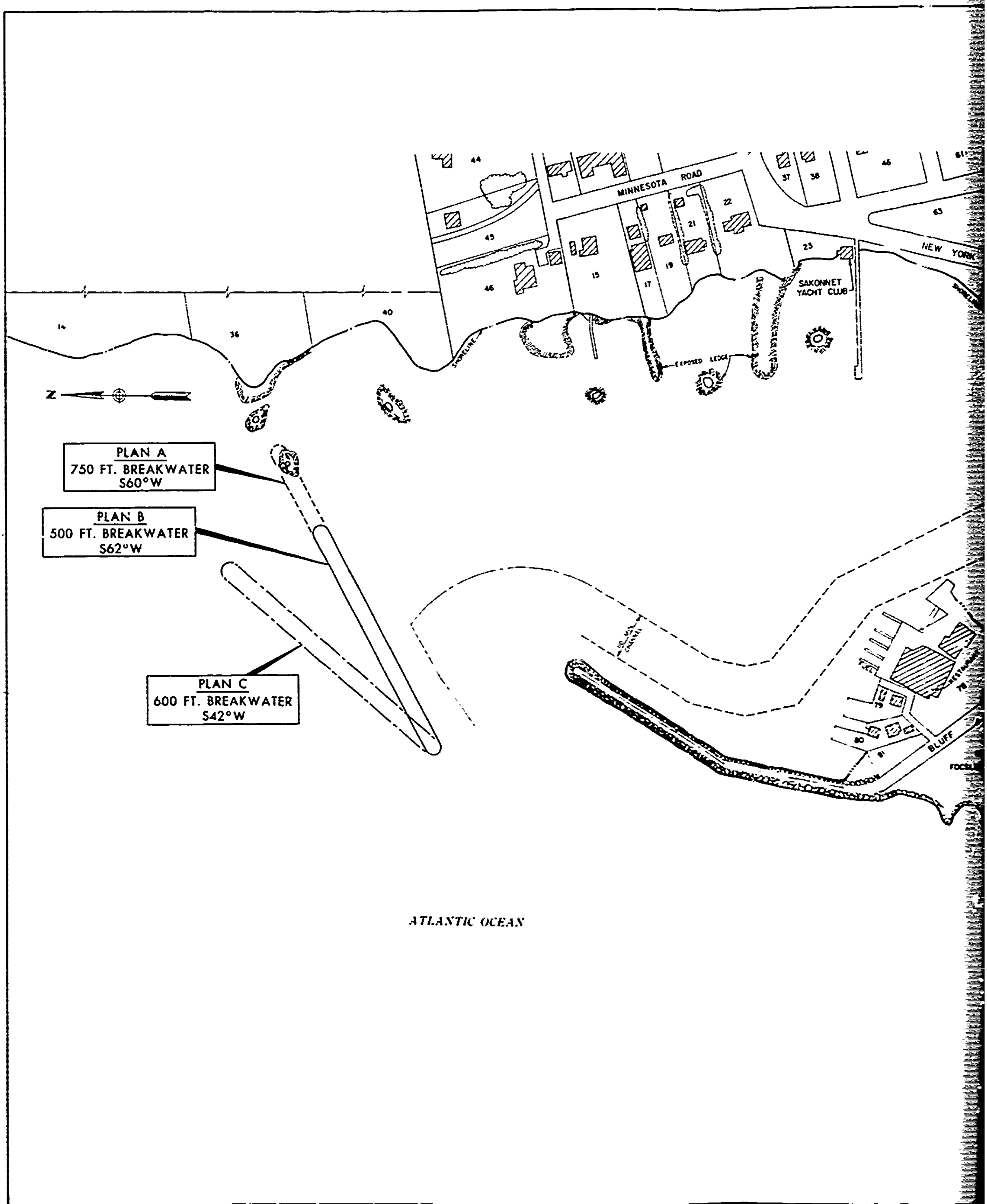
PLAN C

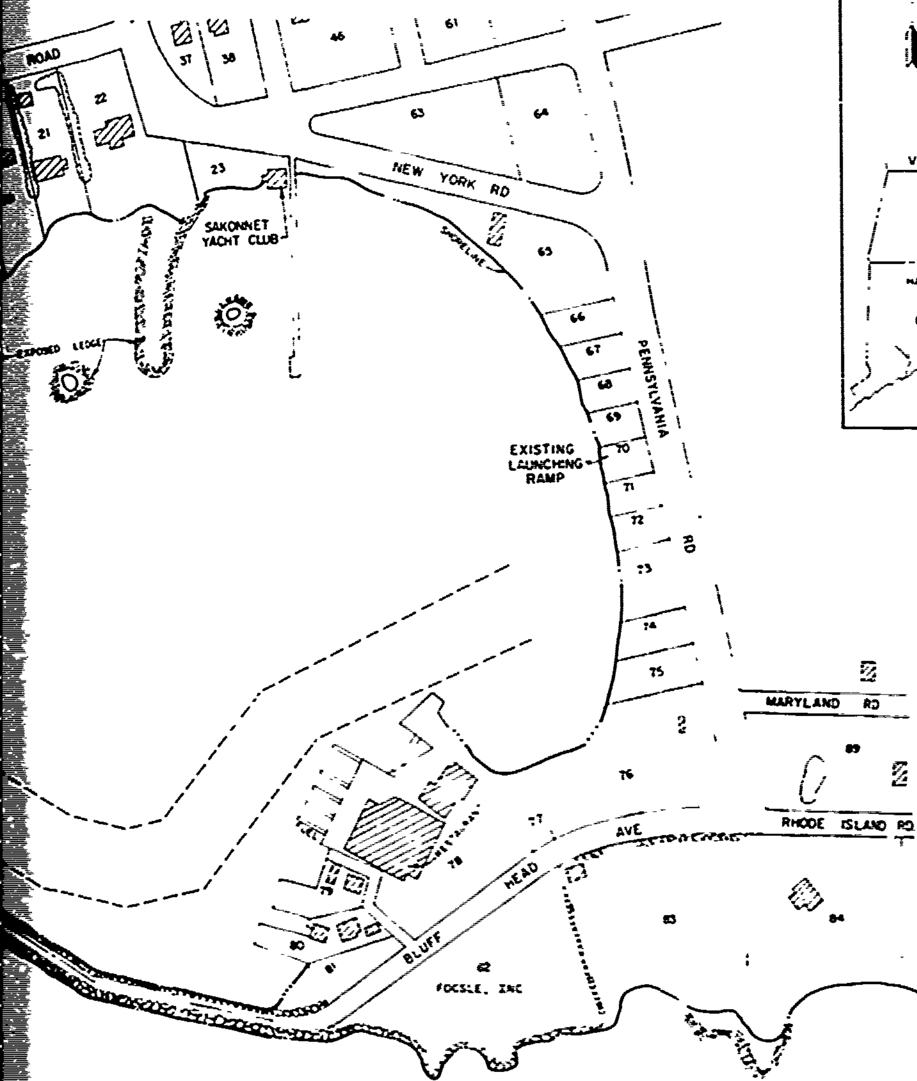
DATE SEPTEMBER 1980 | SCALE 1"=100'

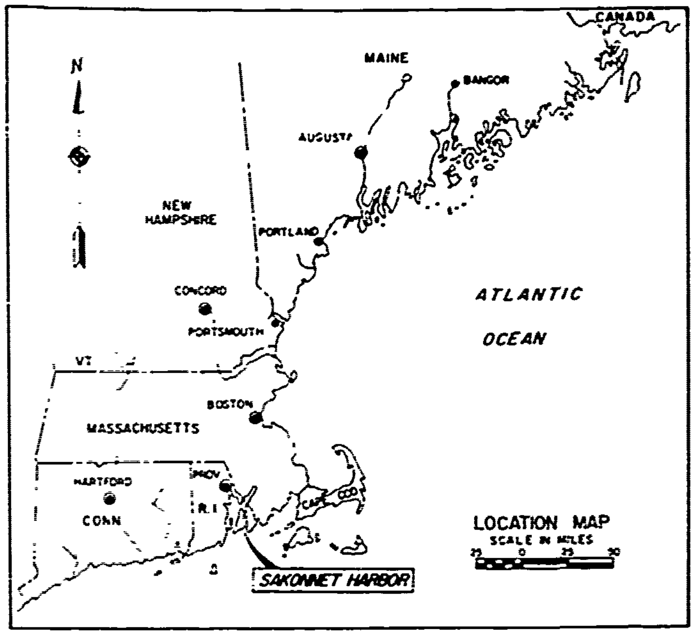
FIGURE 2-5



MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
SHORELINE
EXPOSED LEDGE
PLAN A
750 FT. BREAKWATER
S60°W
PLAN B
500 FT. BREAKWATER
S62°W
PLAN C
600 FT. BREAKWATER
S42°W
BLUFF
ATLANTIC OCEAN

1





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WATER RESOURCES IMPROVEMENT STUDY

PLAN A, B & C

DATE SEPTEMBER 1980 | SCALE 1"=100'

FIGURE 2-6

SECTION C

Comparison of Alternative Plans

41. In general, there is a trade-off between minimizing wave heights, ice floes, and costs, while maximizing water quality and benefits.

42. Plan A, by virtue of protecting the greater part of the harbor would minimize wave height. But, with the exception of this positive impact, Plan A in all other aspects is negative. The plan is more costly than B or C while not providing any additional benefits. Also, the impact on water quality within the harbor exceeds the other two plans.

43. Plan B, provides a similar amount of benefits at a lower cost while having a less significant impact to the environment.

44. Plan C, which has the least impact on water quality does so at a greater expenditure of cost and provides less quantifiable benefits over Plan A or B.

SYSTEM OF ACCOUNTS

45. The System of Accounts is a summary evaluation required by the Principles and Standards. The System of Accounts provides in a concise format an evaluation of the alternative plans in terms of the national objectives of National Economic Development (NED), Environmental Quality (EQ), national accounts of Social Well-Being (SWB) and Regional Development (RD). It also demonstrates plan performance in terms of the planning objectives and constraints; the technical, economic, and other criteria, as well as other measures such as plan acceptability.

46. The System of Accounts is shown in Table 2-9. The summary assessments indicate that the plans have varying responses to the different national objectives and accounts. In evaluting all impacts considered, Plan B is shown to be the most favorable option considered.

TABLE 2-9

System of Accounts

	PLAN A	PLAN B	PLAN C
Structures-Federal	- 750 ft. rubblemound breakwater on South 62° West bearing - dredging 110 ft wide navigation channel	- 500 ft. rubblemound breakwater on S62°W bearing - dredging 110 ft wide navigation channel	- 600 ft. rubblemound breakwater on south 60° West bearing - dredging 110 ft wide navigation channel
Structures-Local	- redevelop existing commercial facilities	Same as A	Same as A
NATIONAL ECONOMIC DEVELOPMENT			
Implementation Costs			
Federal	$2,000,000	1,800,000	2,000,000
Non-Federal	482,700	0	115,600
QUANTIFIABLE TOTAL			
Average Annual Benefits	$232,900	$232,900	$152,200
Increased Net Income to Fishermen	11,700	11,700	9,000
Transportation Savings	4,500	4,500	4,500
Reduction in Damages	$249,100	$'49,100	$165,700
TOTAL			
Average Annual Costs			
Interest and Amortization	$188,500	$136,600	160,600
Maintenance (Breakwater)	20,000	15,000	17,000
Maintenance (Channel)	2,400	2,400	2,400
TOTAL	$210,900	$154,000	180,000
Benefit-Cost Ratio	1.2	1.6	0

Table 2-9 (Cont'd)

	PLAN A	PLAN B	PLAN C
ENVIRONMENTAL QUALITY			
WATER QUALITY			
Turbidity at Dredge Site Effluent Discharge at Dredge Site	Yes	Yes	Yes
Disposal Promotes Leaching of Effluent into Tidal Lands	No	No	No
	No	No	No
Breakwater Interferes with Tidal Currents	Yes	Yes	Yes
Breakwater Decreases Water Quality	No	No	No
AIR QUALITY			
Increased Fuel Emissions from Vessels and Vehicles	Yes	Yes	Yes
Short Term Dust Conditions at Disposal Site	Yes	Yes	Yes
Dust and Noise at Dredging Area	Yes	Yes	Yes
Dust and Noise at Off-Shore Construction Sites	Yes	Yes	Yes
Short Term Marine Odor During Dredging Operations	Yes	Yes	Yes

Table 2-9 (Cont'd)

	PLAN A	PLAN B	PLAN C
LAND USE (Present)			
Wetlands Lost	None	None	None
Commercial Land Use Disrupted	No	No	No
Residential Land Lost	Yes	Yes	Yes
Sufficient Land for Land Disposal	Yes	Yes	Yes
Recreational Land Lost	None	None	None
Wildlife Area Lost	None	None	None
PLANTS			
Terrestrial Vegetation Destroyed	Yes	Yes	Yes
Aquatic Vegetation Destroyed	Yes	Yes	Yes
ANIMALS			
Wildlife Displaced	Yes	Yes	Yes
Wildlife Destroyed	No	No	No
Benthic Fauna Destroyed	Yes	Yes	Yes
Temporary Disruption of	Yes	Yes	Yes
Fish Habitat		No	No
Permanent Disruption of Fish Habitat	No	No	No
VISUAL APPEARANCE			
Loss of Aesthetics	No	No	No
Support Construction Required	No	No	No
Industrial/Commercial Development Encouraged	Yes	Yes	Yes
Land Filling Necessary	Yes	Yes	Yes
Increase Vehicle Activity In Existing Port Area	Yes	Yes	Yes
Increase Vehicle Activity in Other Area	Yes	Yes	Yes
Archeological and Historical Value Lost	None	None	None

Tab;e 2-9 (Cont'd)

	PLAN A	PLAN B	PLAN C
SOCIAL WELL BEING			
Encourages a Diversified Base through New Industrial Development	Yes	Yes	Yes
Decreases Risk of Vessel Collision	Yes	Yes	Yes
Short Term Disruption of Vehicular Traffic	Yes	Yes	Yes
Concentration of Heavy Equipment Increases Potential Hazard to Health and Safety During Construction	Yes	Yes	Yes
Overall Navigation Project will Require Local Labor	No	No	No
Related Development of Facilities Will Require Local Labor	Yes	Yes	Yes
Industrial, Commercial, and Residential Relocation Necessary	No	No	No
Disrupts Commercial Business Activities	Yes Short Term	Yes Short Term	Yes Short Term
Disrupts Recreational Activities	Yes Short Term	Yes Short Term	Yes Short Term
Related Commercial Development will Increase Tax Revenues	Yes	Yes	Yes
Large Local Investment Required to Develop Related Commercial Facilities	Yes	Yes	Yes
Project Makes Maximum Use of Existing Commercial Facilities	Yes	Yes	Yes
Disrupts or Overextends Police and Fire Protection	No	No	No

Table 2-9 (Cont'd)

	PLAN A	PLAN B	PLAN C
REGIONAL DEVELOPMENT			
Supports Industrial and Commercial Growth	Yes	Yes	Yes
Provides Service and Maintenance Facilities	No	No	No
Majority of Construction Labor for Basic Project Hired Locally	-	-	-
Construction Expenses Would Increase Local Income Through Secondary and Induced Economic Activity	Yes	Yes	Yes
Non-Federal Government Funds Required for Implementation of Portion of Project	Yes	No	Yes
Disrupts Commercial Production During Implementation	Yes	Yes	Yes
OTHER EVALUATED CRITERIA			
Minimizes Adverse Social Impacts	Yes	Yes	Yes
Navigation Benefits Exceed Costs	Yes	Yes	Yes
Efficient Method for Meeting Needs of Sakonnet Harbor Commercial Boating	Yes	Yes	Yes
Plan is Acceptable to Town Planners	No	Yes	Yes
Plan is Acceptable to State Agencies	Yes	Yes	Yes
Plan is Acceptable to Other Federal Agencies	Yes	Yes	Yes

Table 2-9 (Cont'd)

	PLAN A	PLAN B	PLAN C
Plan is Acceptable to Private Concerns	No	Yes	No
Plan Compliments Redevelopment Plans of the Town	No	Yes	Yes

Selecting a Plan

47. Selection of a plan of improvement to Sakonnet Harbor has been based on considerations of economic efficiency, preservation of environmental quality, boating safety, and the needs and objectives of the local and state governments.

National Economic Development Plan

48. Of the three alternatives evaluated in this study, Plan B would provide the greatest net benefits. Appendix 5 of this report contains the detailed benefit cost studies for the three alternatives. As the benefit cost analysis indicates, Plan B maximizes the net benefits and has therefore been designated the National Economic Development Plan.

Environmental Quality Plan

49. The Environmental Quality Plan is the alternative which makes the most significant contribution to the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems. All three alternatives considered would have positive effects on enhancement, preservation, and restoration of cultural resources.

50. Because Plan C would allow for the maximum flushing action within the harbor, it has been designated the Environmental Quality Plan. Plan C has not been selected however, because the differences between Plans B and C have been determined to be not significant and the greater net benefits attributable to Plan B outweigh the minor increase in water flow within the harbor.

SECTION D

The Selected Plan

51. Plan B has been chosen as the selected plan of improvement for Sakonnet Harbor. The associated harbor improvements required by Plan B are described in more detail in this section, as are the construction and maintenance procedures. General environmental impacts of the plan are also outlined in this section.

Plan Description

52. As is shown in Figure 2-3, Plan B will consist of constructing a 500-foot rubble mound breakwater and dredging of a 1,155 foot access channel with a width of 110 feet and a mean low water depth of 10 feet. Table 2-10 summarizes the major features of Plan B.

Table 2-10
Pertinent Data - Selected Plan

Breakwater

Type:	Rubblemound
Length:	500 feet
Crest Elevation:	+8.0 feet
Crest Width:	
Head:	10 feet
Trunk:	8 feet
Side Slopes:	
Head:	2 horizontal to 1 vertical
Trunk:	1-5 horizontal to 1 vertical
Volume:	22,300 cubic yards

Channel

Length:	1,155 feet
Width:	110 feet
Depth	10 feet (mlw)
Side Slopes	1 on 3
Dredge Quantity	8,000 cubic yards

Evaluated Accomplishments

53. The evaluated accomplishments that would result from the selected plan of improvements are the commercial fishing benefits that would accrue to fishermen in the town of Little Compton. The fisheries resource off the coast of Rhode Island is capable of sustaining an increase in the average yearly catch, and the proposed plan would enhance the capability for commercial fishermen to take advantage of the available resource. The selected plan would result in estimated net annual benefits of $95,100.

General Impacts of Construction

Construction

54. Assuming Federal authorization and appropriation, and local cooperation, the proposed improvements at Sakonnet Harbor could be designed and constructed within two years. Rock material is available at a nearby quarry in Tiverton, and that quarry has access to loading facilities on the Sakonnet River. The rock would be loaded at Tiverton and barged 9-1/2 miles down the Sakonnet River to the site, and deposited through bottom-opening and over-the-side dumping equipment to form the blanket and core of the breakwater. Bedding and armor stone would be brought down the river in the same manner but would be placed, stone by stone, according to the required thickness, grade and slope. Dredging of those limited areas along the entrance channel and in the maneuvering area is a small scale operation involving appeoximately 8,000 cubic yards of material. This operation has been described in some detail in Appendix 4.

Maintenance

55. The major element of maintenance will be to repair damage to the armor stone which would be produced by waves of unusually severe Atlantic storms. It is estimated that such maintenance would amount to replacing and restoring approximately 2,000 tons of stones every 10 years at an average annual cost of $15,000. Maintenance of the channel depth is not expected to be a serious problem due to limited shoaling processes. Based upon an assumed shoaling rate of 160 cubic yards per year it is estimated that maintenance dredging will be required every 10 years involving the removal of approximately 1,600 cubic yards of material by hydraulic methods. The annual cost for providing maintenance dredging is estimated at approximately $2,400. The only remaining element of maintenance would be the routine upkeep of the channel markers and other aids to navigation by the U.S. Coast Guard. This maintenance is estimated at an average annual cost of approximately $200. This data is discussed further in Appendix 4.

Water Quality

56. Short Term Effects - Breakwater: The deposition of rock into the waters of Sakonnet Harbor to form the blanket and core of the new breakwater may cause a slight increase in the turbidity of the water near the construction site. However, this turbidity, which is caused by rock dust, will quickly disperse in the deep waters of the harbor and will cause no short term adverse affects on marine life.

57. Short Term Effects - Dredging: The dredging operation required to meet the objectives of the selected plan of improvements is one of the very limited scope. The total volume to be removed from the selected channel and maneuvering areas is approximately 8,000 cubic yards of material. The maximum depth of dredging is three feet, including the required overcuts. Twelve rock probes were taken during the late winter of 1978 to determine the presence of ledge between the existing harbor bottom and El. -12.0 (m.l.w.). Logs of these probes indicate that ledge is not present in those areas which are to be dredged to El. -10.0 (m.l.w.). Existing information on the nature of the material at the harbor bottom indicates that said material consists of hard-packed sands and gravels interspersed with stones and boulders. A further indication of the dense nature of the bottom material is provided by the "blow counts" on the probing rods as recorded in the logs of the twelve rock probes referred to above. There is no indication from any available source of any substantial deposits of organic bottom sediments.

58. The removal of these sands and gravels will cause some turbidity in the waters of the harbor. However, this turbidity will only last a short time since the relatively larger grain sizes of the granular materials involved will quickly settle to the bottom. Moreover, high turbidities in themselves are not injurious to most marine life according to recent research at the University of Rhode Island. Since the turbidity will contain very small amounts of organic materials, the short term effects on marine life of the dredging operation will be negligible.

59. Disposal of Dredged Material: Since the materials to be dredged consists almost entirely of sands, gravels, and rock boulders and/or fragments, the disposal of such material presents no unusual problems. As Appendix 4 illustrates, local interests will provide a land disposal site in close proximity to the project site. Thus, the disposal of the dredge material will be accomplished expeditiously and economically. Finally, since there is no evidence of any substantial deposits of organic materials in the areas to be dredged, all of the difficult environmental and social problems usually associated with the disposal of such material will be avoided.

60. Long Term Effects - Breakwater: As previously noted, the proposed breakwater will not meet the easterly shore of Sakonnet Harbor. A waterway opening is thereby retained between the shore and easterly end of the breakwater. This open water passage will allow a constant tidal flushing of an area that otherwise would be a quiet backwater location. Because of the tidal flushing action, this corner area will be kept free of floating flotsam and other debris that would certainly collect here if the breakwater connected to the shore. This tidal flushing feature is considered a positive and beneficial long term environmental impact of the selected plan of improvement.

Other Effects

61. The implementation of the selected plan of improvement at Sakonnet Harbor will produce other beneficial effects, most particularly to the existing recreational fleet. While these benefits are relatively minor compared to those that accrue to the commercial fleet, and therefore have no bearing on the economic justification of this project, they should, nevertheless, be noted.

62. The provision of the proposed breakwater will immediately encourage the mooring of vessels in the north section of the harbor in the lee of the proposed structure. It should be noted however, that while the breakwater will protect the fleet from the occasional northerly summer storm, it will not reduce, and in fact even increase the wave heights generated during southwesterly storms. Wave refraction/diffraction results show that existing wave heights during periods of southwesterly storms are on the order of nine feet. After the proposed structure is in place, wave heights may increase to 10.5 feet in height. So the new breakwater would provide some measure of protected for the recreational vessels in the harbor but any future mooring management plans to be instituted for the harbor must account for the danger to vessels moored in the area behind the new breakwater during periods of high southwesterly winds.

63. The small amount of anchorage area that is taken out of use by the designation of a 100-foot Federal channel (approximately 1/2 acre) will probably be mitigated by some increased usage of the northerly areas at natural depth and/or better management of existing moorings in the harbor.

64. Air quality in the proposed project area may be affected by dust, noise, odors, and vehicle emissions from the operation of construction equipment. The construction contractor will be required to control such factors where feasible.

65. The presence of construction vessels in Sakonnet Harbor could result in the release of oils and greases into project area waters through accidental spillage. The construction contractor will be required to implement all necessary measures to prevent degradation of water quality by construction equipment.

66. Neither construction of the proposed project nor the completed project are expected to disrupt or threaten any endangered species of aquatic or terrestrial wildlife. This subject is discussed more fully in subsequent paragraphs.

67. As indicated in Figure 2-4 the proposed breakwater will not meet the existing shoreline at any point. Instead, it will commence approximately 450 feet from the shoreline. Thus, it is fully anticipated that delivery of rock and construction of the breakwater will be carried out entirely from the water surface of the Sakonnet River and Harbor, respectively, through the use of work barges and boats. Accordingly, there is no provision for the establishment of a major shore base for construction materials and equipment. Only a manpower base will be required on the shore; a place for a small field office; a parking lot for the workmen, and a departure point where they can be ferried to and from the work barges. There appears to be ample room for such a manpower base in the large parking lot directly across from the Foc'sle Restaurant. Thus, the impact of the construction operation on the local transporation system will be very slight and well within its capabilities.

68. The physical characteristics of existing residential and commercial buildings will not be affected during construction. No buildings will be displaced and, therefore, there will be no displacement of local residents nor will implementation of the project interfere with any fish traps north of the harbor entrance.

69. A temporary increase in the demand upon local utilities, such as water and electricity, will occur due to the presence in the area of construction equipment and personnel. Such increases, however, are well within the capability of the respective utilities to provide.

70. The esthetic characteristics of the Sakonnet Harbor community will be affected only slightly during construction of the proposed project. These effects will include the visilibity of construction equipment, the noise generated by said equipment, plus dust, and perhaps mud, generated by the vehicles transporting workmen to and from the work site. These short term effects are those usually associated with heavy construction and are usually accepted by the local community as such.

71. Construction equipment and activities will create potential safety hazards to small boaters in Sakonnet Harbor. Community services, such as rescue, law enforcement and medical services may be utilized if their particular assistances are required.

SECTION E

Implementation Responsibilities

Cost Allocation

72. Allocation of costs of the project include $1,469,000 for the breakwater and $136,000 for the channel.

Cost Apportionment

73. The Federal Government would be responsible for 100 percent of the cost to construct the breakwater and channel. Local governments would be responsible for all costs associated with construction of the dike for containment of the dredged material.

Federal Responsibilities

74. The Federal Government will assume all costs, within the cost limitation of $2,000,000, for initial construction of this project because of the general, or widespread nature of benefits to commercial navigation. In addition, the Federal Government will maintain the waterway improvements, assuming continued need and justification, to assure continued navigability. All pre-authorization study costs, as well as the design, preparation of plans and specifications, and contract administration are Federal responsibilities.

Local Responsibilities

(1) Provide, maintain and operate without cost to the United States, an adequate public landing with provisions for the sale of motor fuel, lubricants and potable water open and available to the use of all on equal terms.

(2) Provide without cost to the United States all necessary lands, easements and rights-of-way required for construction and subsequent maintenance of the project including suitable dredged material disposal areas with necessary retaining dikes, bulkheads and embankments therefor.

(3) Hold and save the United States free from damages that may result from construction and maintenance of the project.

(4) Accomplish without cost to the United States alterations and relocations as required in sewer, water supply, drainage and other utility facilities.

(5) Provide and maintain berths, floats, piers, and similar marina and mooring facilities as needed for transient and local vessels as well as necessary access roads, parking areas and other needed public use shore facilities open and available to all on equal terms. Only minimum, basic facilities and service are required as part of the project. The actual scope or extent of facilities and services provided over and above the required minimum is a matter of local decision. The manner of financing such facilities and services is a local responsibility.

(6) Assume full responsibility for all project costs in excess of the Federal cost limitation of $2,000,000.

(7) Establish regulations prohibiting the discharge of untreated sewage, garbage, and other pollutants in the waters of the harbor users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State and local authorities responsible for pollution prevention and control.

SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

PUBLIC VIEWS AND RESPONSES

APPENDIX 3

Prepared by
Department of the Army
Corps of Engineers
New England Division

PUBLIC VIEWS AND RESPONSES

Table of Contents

Town of Little Compton
Rhode Island

September 22, 1977

Mr. Joseph Z. Ignazio
Chief, Planning Division
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Ignazio:-

1. References: (a) Letter dated November 22, 1975 to the Division Engineer from the Harbor Advisory Board Little Compton

(b) Letter with enclosure dated February 7, 1976 to the Division Engineer from the Harbor Advisory Board.

2. This letter is in reply to your letter of 20 January 1977. The delay in our reply should not be construed as any lack of interest in improving Sakonnet Harbor. Quite to the contrary. We are desirious of improving our harbor as indicated in our earlier letters, references above. The data which you requested can only be obtained from the more than 150 boat owners who operate from the harbor and some of them have been difficult to contact and others reluctant to furnish the quantity and value of landings. This response thus is based on such information as we were able to solicit and estimates were made on the balance.

3. We are not only interested in improving our harbor, we are confident that the economic circumstances have so changed since your 1969 report that there can be no doubt that the desired improvements are economically feasible. These changes include:

(a) The advent of an offshore lobster fishery.
(b) The newly established 200 mile limit on U.S. jurisdiction over its coastal waters.
(c) The market replacement with ocean quahogs of decimated New Jersey sea clams.
(d) The interest in offshore exploration for oil and gas.

4. Sakonnet Harbor presently includes:

140 moorings
25 boat slips
2 launching ramps
Private dockage (three owners) where six or more commercial craft regularly berth
8' project depth in an anchorage of about six acres

Town of Little Compton
Rhode Island

The craft currently using Sakonnet Harbor are enumerated in enclosures A parts I - IV.

5. The improvements which we hope to achieve with help from the Federal Government include:

(a) A northerly breakwater to protect the harbor from seas and floating ice generated by north and northwest winds. We would hope to have an energy absorbing rubble mound breakwater starting about 150 feet from the easterly shore of the harbor and extending about 650 feet in a west southwesterly direction with an opening between breakwaters of not less than 200 feet. We would be pleased if the engineers would consider openings between 200 and 400 feet proposed in your 1969 report and select that opening which gives greatest protection within the harbor, minimizes the energy reflected into the harbor, assures a tidal flow which will not adversely effect water quality in the harbor (the harbor is presently used for swimming and we urgently desire to retain this use) and does not increase shore erosion nor act as a sand trap to increase harbor maintenance. The present breakwater adequately accommodates shore fishermen and we desire that the new breakwater not be used for shore fishing. Further we are desirous of having the breakwater constructed from barges using stone delivered by barge to minimize problems of rights of way and traffic congestion.

(b) A 12 foot deep 150 foot wide channel to serve the commercial (westerly) side of the harbor to the south harbor line. Messrs. James Mataronas, Jr. and Richard Rogers each own lots adjacent to the harbor (lots 83 and 75 respectively) and have indicated a willingness to provide land for the disposal of dredge spoil. They also have stated a willingness to provide at their expense whatever retaining structures may be required to contain the spoil and minimize pollution. Mr. Rogers has indicated an interest in having the Corps engineers construct his retaining structure and dredge his proposed boat slips if the cost by your contractor were equal or less than his cost by another contractor. And as the start of construction approaches we expect others may want deepened berths along side other docks.

Town of Little Compton
Rhode Island

(c) An increase of 2 to 3 acres in the sheltered anchorage.

(d) The location of these desired improvements are marked on the layout attached as enclosure B.

(e) These improvements in the Federal Project are expected to induce local improvements to include:

(1) The construction of six additional boat slips for 70' offshore lobster boats, draggers and trawlers.

(2) The construction and operation of a boat lift and a marine service and storage facility.

(3) Increased moorings to include moorings that can be reserved for transients using Sakonnet as a harbor of refuge provided there is a national benefit in so doing.

6. The benefits which we perceive would flow from these improvements include:

(a) A longer fishing season
(b) A more diversified fishing industry
(c) Increased protection for commercial and recreational craft
(d) A harbor able to accommodate a 50 percent increase in resident craft
(e) Increased boating safety in Southeastern New England
(f) Savings to boat owners who could have their boats serviced and stored in Little Compton
(g) Increased landings as follows:

Crabs	1,000#
Codfish	20,000#
Fish (gill nets)	5,000#
Fish (traps and draggers)	2,000,000#
Lobsters	450,000#
Quahogs	10,000,000# (in sh

(h) Reduced unemployment. Little Compton is plagued with a 10 to 12% unemployment rate in winter time. Increased employment in winter fishing and boat maintenance and storage will add significantly to our winter employment opportunities in skills that are available in Little Compton.

Town of Little Compton
Rhode Island

7. We are looking forward to working closely with your office in the preparation of whatever further reports you may require for the early realization of these improvements.

Very truly yours,

Jane P. Cabot

President, Town Council

Enclosures: (A) Harbor layout
(B) Current use statistics

cc: Senator Clairbone Pell
Representative Fernand J. St Germain
Mr. John Lyons

Tony Ciarone coastal ... 113N

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

January 3, 1978

Mr. Gordon R. Archibald
56 Pine Street
Providence, Rhode Island 02903

Dear Mr. Archibald:-

This letter confirms the request of the Harbor Commission made to you on 28 December 1977 and the telephoned recommendations of the undersigned December 30 as follows:

1. Please keep the 10 foot channel as close to lots 79 and 80 (commercial piers of Wilcox and Manchester) as possible while at the same time encroaching on the mooring area as little as possible. Mr. Manchester has indicated that when a deeper channel is provided at Sakonnet Harbor he expects to upgrade his fleet and increase the number of his craft that would be using pier 80. We urgently request that the 10 foot channel extend to the harbor line in front of piers 79 and 80. These owners hope to have the Corps dredging contract also dredge 10' berths along side their docks. There is no objection to narrowing the channel to 55 feet between points C-3 and C-4 on your drawing to reduce the cost of excavation.

2. Please review the size of the armor stone. It is believed to be much too small on the southwest end and the northwest face of the northerly breakwater. 8 to 10 ton stones seem to be necessary for stability and energy absorption. For your information waves generated by a northerly wind often top the present breakwater and have dislodged stones from the outside face and deposited them inside the harbor.

3. There is no indication that the breakwater is to be a rubble mound energy absorbing breakwater on both faces, but particularly on the inside to prevent waves being reflected into the harbor.

4. I provided to you my only copies of the bottom surveys that were done by the Corps in the summer of 1977. Request they be returned.

5. My recollection of the above referenced surveys and House Report No. 436, 82nd Congress April 23, 1952 (copy enclosed) suggests that the bottom contours shown on your December 13 preliminary drawing are in error and the ledge rock is more extensive than you described in your meeting with the Board.

JAN 9 1978

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

6. Please eliminate from your drawing the names of adjacent land owners.

7. From lot 76 please erase "Fo'c's'le Restaurant" and the present Thayer house and garage. Move the house over to lot 75 as the caretakers house and adjust "F" lobster storage and handling shed so that it lies wholly on lot 76.

8. Show lots 72-74 as "Reserved for Town Dock (future)" and show outline of proposed dock as indicated on drawing enclosed.

9. Show lots 70 ~~and 71~~ as: "Reserved for boat launching ramps".

10. Show lots 66-69 as "Reserved for swimming".

11. Show lot 65 as "Reserved for beaching and servicing water craft".

12. Please provide to me not later than January 20 a visual cast transparency of your final harbor layout including the changes requested herein. I expect to use it at the Towns' public hearing on a Town Master Plan.

The information you requested 19 December 1977 on gear used by the commercial fleet is enclosed.

I understand you expect to provide me a draft of your report on or before January 15, 1978. I shall see that it is reviewed and comments, if any, furnished promptly. I trust it will cover the influence of the project on the water quality of the harbor.

Thank you for your efforts and your cooperation.

Very truly yours,

Harry Woodbury

Harry Woodbury

cc: Members, Harbor Board
Harbor Master
James J. Rocha
Division Engineer

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

January 9, 1978

Gordon R. Archibald, Inc.
56 Pine Street
Providence, Rhode Island 02903

Dear Mr. Archibald:-

1. Thank you for sending the Harbor Board copies of the (1) memorandum dated 30 December, 1977, (2) the Benefit determination (final) dated December 2, 1977 and revised January 3, 1978 and (3) the drawings showing the harbor layout. We are looking forward to receiving an 8x10 visual cast slide of the layout for use at the Town's public hearing this month on the Town's Comprehensive Community Plan.

2. With respect to the benefit cost determination the following comments and recommendations are offered:

a. Benefits

(1) Comment: The Board is concerned that the benefit/cost ratio for the northerly breakwater without the deepened channel is unfavorable and wishes to clarify, what we obviously did not make clear at our meeting with you on 28 December.

(a) When the breakwater is built, it will become feasible to build the new slips at the southwest corner of the harbor for year round commercial use, although not for the 65' off shore lobster boats. We would expect ~~would~~ could be 45' multiple purpose craft drawing 5 to 6 feet that would fish with pots for lobsters, dredges for quahogs and gill nets for black bass, striped bass, blue fish and cod landing annually at least 20,000 pounds of lobsters, 50,000 bushels of quahogs and 40,000 pounds of fin fish.

(b) The breakwater will also prevent annual storm damage valued at least at: $2,000. for the home commercial fleet, $2,500. for transient commercial vessels, $2,000. for home recreation craft and $2,000. for transient recreation crafts.

Recommendation

(a) Include the benefits accruing to the breakwater alone at:

(1) Increased landings from six new major multiple purpose boats

(2) Damage prevention

Town of Little Compton
Rhode Island

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(2) Comment: The damage prevented is a benefit also to the breakwater with the deepened channel.

Recommendation: Include the benefits for damage prevented in the analysis of the alternate project of a breakwater and deepened channel.

3. I understand that the report may be delayed a month or so because the Corps may initiate additional subsurface exploration to define better the classes of excavation.

(a) We would appreciate being advised of the name of the organization that will undertake the probes in order for Mr. Rogers to secure his services for exploration in his proposed dock and mooring area.

(b) If the exploration reveals conditions substantially different from those on which your January 3 cost estimate was based we request an early meeting with you. We are most anxious to realize these improvements as soon as possible and would hope to prevent the delays that would attend project authorization and funding for projects over two million dollars.

4. Thank you for your consideration.

Very truly yours,

Harry Woodbury

Harry Woodbury

cc: Oscar C. Arpin
Office of Division Engineers
United States Army
424 Trapello Road
Waltham, Massachusetts 02154

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

January 17, 1978

Mr. Oscar Arpin
Office of Division Engineers, U.S. Army
424 Trapello Road
Waltham, Massachusetts 02154

Dear Mr. Arpin:-

We are gratified at the progress the Corps has made on our harbor study and understand there is a possibility the project may be funded to start construction in 1979. The Town wants to be in a position to provide promptly whatever assurances may be required to permit construction to start. Such assurances may require the approval of the Town at a Town financial meeting. The Town normally has such a meeting only once a year. The meeting this year is set for April 4, 1978.

Requests for strokes in the budget must be submitted to the Town on or before 15 February and then be subjected to hearings by the budget committee. We are, therefore, in urgent need of your advise concerning the local assurances which you anticipate will be required before the Corps of Engineers can proceed with the project. We would appreciate your early advise on this matter.

Thank you for your assistance.

Very truly yours,

Harry G. Woodbury

Harry G. Woodbury

cc: Gordon Archibald Assoc.
File

Town of Little Compton
Rhode Island

HARBOR BOARD

January 26, 1978

Mr. Oscar Arpin
Chief, Coastal Development Branch
U.S. Army, Corps of Engineers
424 Trapello Road
Waltham, Massachusetts 02154

Dear Oscar:-

1. The Harbor Advisory Board has reviewed the suggestions for local assurances as kindly furnished by your office and offers the following comments and recommendations for your consideration:

a. Comment: Items 1, 2, 3 and 7 are clear and acceptable.

b. Comment: Item 4 has no application to the project.

Recommendation: Delete item 4 and renumber subsequent items.

c. Comment: Item 5 is so general with respect to "similar marina -- facilities as needed" and "other needed public use shore facilities" that the Board is unable to define with any certaintude the financial obligation of the Town or the basis and authority for determination of need. It would appear that an assurance more directly related to the benefits anticipated from the project, as was done in the case of Point Judith, would be appropriate.

Recommendation: Substitute for your proposed item 5 (renumbered 4) the following:

"4" Ensure the provision of berths, floats and piers connected with the federal channel and supporting access roads and parking facilities determined by the Town Council to be necessary to facilitate upgrading and modernization of the existing commercial fleet and the additions of berths, floats, piers and supporting shore facilities for a minimum of six general purpose commercial fishing vessels 50 to 70 feet in

Town of Little Compton
Rhode Island
HARBOR BOARD

length and drawing 7 to 8 feet loaded draft"

d. Comment: Item 5 (formerly #6). We quite understand the limitations of section 107 project authorization and we understand that if the construction work estimate (C W E) at the time of bid opening and before award should exceed $2,000,000. the Town has the option of paying the costs in excess of $2,000,000. or proceeding under survey report proceedures. We would urge that there be a third alternative of selected reduction of the scope of work without significant adverse effect on the benefit cost ratio so as to keep the costs within the capability of the Town to finance. We would appreciate your confirming that the Town has these alternatives. We have a further concern that after the contract is awarded cost controls by the Federal Government will prevent any liability accruing to the Town resulting from cost overruns to which the Town has not agreed prior to the contractor incurring the costs. Otherwise this assurance is a blank check from the Town which effectively removes most of the inducement for cost control on the project. It would seem fair and reasonable after the contract is let, to provide the Town with a C.W.E. monthly that includes latest estimates of quantities and all estimates for all contract modifications the cost of which might fall upon the Town ~~so, in order~~ as an alternative, to Enable the To negotiate for a reduction in the scope of work to bring project costs within the Towns' capabilities and authorization for the project. Just as the Federal Government has to have control of its obligations so does the Town!

Recommendation:

(1) Confirm by letter at the time the D P R is issued an understanding of how the Town can control its obligations or

(2) Modify the language of the assurance by adding the following: "Provided that no costs which will cause the project costs to exceed $2,000,000. will be incurred by the Federal Government or its

Town of Little Compton
Rhode Island

HARBOR BOARD

contractors without express written authorization in advance from the Town specifying the amount of obligation the Town is accepting.

2. Thank you for your consideration. I shall be pleased to meet with you in your office at your convenience prior to February 7 (when we have our next Board meeting) to complete a mutually acceptable understanding of the assurances the Town will furnish in connection with the proposed harbor improvement.

Sincerely yours,

Harry Woodbury

Harry Woodbury
Chairman

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

July 5, 1978

Mr. Oscar Arpin
Planning Division, Corp of Engineers
424 Trapello Road
Waltham, Massachusetts 02154

Dear Oscar:-

Reference our telephone conversation July 3.

In the afternoon of July 3 I met for 1½ hours with seven members of the Sakonnet Yacht Club who made known objections they had to the breakwater and channel improvement and questions concerning the draft report by Mr. Archibald. I am summarizing their views that you may take such action as you deem appropriate, as you review and finalize the Archibald draft, to best insure it reasonably addresses all questions of local interests.

1. The gap between the eastern end of the proposed northerly breakwater and the east shore of the harbor is inadequate. The text suggests 150' of opening which would be agreeable to these special interests but the drawing if followed would have only a shallow 20' gap at low tide through which very little water passes and which can be waded encouraging fishing from the breakwater which would be hazardous, encourage trespassing, develop pressures for public parking where none can be made available. Suggest you consider shortening the breakwater at the easterly end to correct these deficiencies and incidentally reduce the cost of the project.

2. Page 23 and page G-2:

a. Reword to make abundantly clear that this division of responsibility is proposed by the Army to prevent, during the review and hearing stages, any implication that the Town has yet agreed to these conditions.

b. Reference my letter of 26 January 1978. It was my understanding as a result of a telephone conversation with your office that you would make the substitution suggested in paragraph C of my letter. If you now have reservations about making this substitution, we would appreciate an opportunity to discuss your reservations and our desires.

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

3. Appendix D sets forth environmental criteria:

a. The criteria should include the Town's desire to maintain water quality in the harbor suitable for swimming.

b. The report does not analyze the influence of the project on these criteria.

4. The northerly breakwater could reflect wave energy into the harbor. The steps being taken to prevent reflection should be clearly set forth.

5. The Yacht Club members who attended the 3 July meeting would like the report to be more specific as to beneficiaries their feeling being that Sakonnet Harbor is being converted to a commercicl harbor for non-Little Compton residents. They question that there will be five additional 65 foot boats unless they are substitutes for existing boats in which case only the net increase should be considered as a benefit.

6. The conferees are particulalry interested in having an opportunity to review the environmental assessment and the evidence (one of the conferees being a lawyer) that supports any conclusion of no significant adverse effects.

Thank you for your consideration.

Sincerely yours,

Harry Woodbury

Harry Woodbury
Chairman

Anthony Garcia

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

August ~~3~~ 16, 1976

Colonel John F. Chandler
Division Engineer, U.S. Army
424 Trapello Road
Waltham, Massachusetts

Dear Colonel:-

We are grateful for the progress you are making in your study of the feasibility of improving Sakonnet Harbor and are looking forward to early receipt of a copy of your proposed report and the summary of environmental analysis. We are concerned however with the language of that paragraph of the items of local cooperation which requires non-federal interests to "Assume full responsibility for all project costs in excess of the federal cost limitation of $2,000.000."

We understand that the latest cost estimate for this project is about $1,750,000. including contingencies. We further understand that this estimate is based on 1976 costs. In these times of inflating construction costs the project costs can be expected to increase substantially before a contract is signed to perhaps $2,275. million. To minimize this escalation we are of course interested in getting the contract let out as soon as possible.

We understand too that after the bids are taken and before an award is made the sponser will be given an opportunity to accept or reject at that time its obligation for costs over $2,000,000. and if it rejects its obligation the Corps will then proceed under the proceedures for Survey Reports.

This leaves the local sponser with two problems if it elects to accept the obligation.

First because the work will probably be bid on a unit price basis, the final cost could overrun greatly because of quantities or conditions and as we understand it the Town would be expected to absorb whatever added costs were thus incurred. It seems only fair and prudent in order to provide some constraint on cost overruns for the local sponser be a party to any agreement concerning changed conditions and/or quantities <u>before</u> the costs are incurred and have the option

to reduce the scope of the work if the costs exceed the sponsers ability or willingness to pay the increase.

The second problem relates to the Town's legal ability to give to the Federal government an open ended authority to obligate the Town and its taxpayers. The Town annually has a financial town meeting at which a Town budget and the tax rate is approved. The budget is for stated amounts for individual line items. The Town is in no better position than is the Corps of Engineers to seek and obtain an obligation authority for an unspecified amount. Some reasonable estimate is believed to be necessary and when the Town appropriates on the basis of that estimate, the estimate then becomes a ceiling. And limitations on costs then must of course be a mechanism for contracting costs. Surely this second problem in the case of Section 107 projects is not peculiar to Little Compton.

Request an opportunity to meet with you at an early date for the purpose of resolving these two potential problems.

Respectfully yours,

Harry G. Woodbury
Harry Woodbury

cc: Lt. Gen. John Morris
Chief of Engineers, U.S. Army
Washington, D.C., 20314

Anthony Garone
Office Division Engineers
424 Trapello Road
Waltham, Mass.

Town of Little Compton
Rhode Island
HARBOR ADVISORY BOARD

September 1[illegible] 1978

Colonel John P. Chandler
Division Engineer
New England Division
Corps of Engineers, U.S. Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Chandler:-

This letter continues the policy of the Board to provide your office all significant information and questions that come to our attention which bear on the study by your office of the economic and environmental feasability of improving Sakonnet Harbor.

On August 6, some of our summer residents requested an opportunity to present their views of the proposed harbor development at the regular meeting of the Board August 16, 1978, inasmuch as they expected to be unable to attend the public hearing on the draft of your report. The meeting was widely publicized by the requesting parties. About 135 attended. Persons who expected to be able to attend the later public hearing were encouraged to refrain from taking time from the people who had requested the meeting. Ten people presented prepared statements or questions. See draft minutes of the meeting attached as enclosure 1. The undersigned requested all speakers having questions to submit them to the Board in writing (a tape recorder had failed). The following were received and are attached:

(a) Enclosure 2: Environmental Impact Questions by Anne Kneeland Ellis.

(b) Enclosure 3: Remarks by Roswell B. Perkins.

(c) Enclosure 4: Memo from N. B. Atwater.

I have also attached for your information:

(d) Enclosure 5: Letter to Jane Cabot (President of Town Council) from David Binger, who organized the meeting.

Mrs. Cabot's reply

(e) Enclosure 6: Letter to the undersigned from Mrs. Bradford Hastings.

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

(f) *Enclosure 7: Letter from Mrs. Thomas Woodhouse to the President of the Town Council, and her reply.*

The Board summarizes the tenor of the presentations as follows:

(a) *The preservation of water quality in the harbor is essential. It is used for swimming and boating safety instruction. How will the proposed breakwater affect the tidal flushing action? Would the flushing action be improved if the breakwater were shortened on the Northeasterly end to 600 feet? How will the increased use of the harbor affect water quality? What steps should be considered by the Town to minimize the pollution caused by users? The architects report presents little evidence or analysis to support its conclusions that the only significant adverse effect will be short term from dredging.*

(b) *Will the proposed improvements create rougher mooring conditions in the harbor from S.W. generated wave energy being reflected off the north breakwater into the harbor? Would not a northeast - southwest orientation to the breakwater reduce this effect significantly? Where may be seen a rubble mound breakwater that absorbs rather than reflects energy?*

(c) *To what degree will the character of the Town as a rural community be changed by the proposed harbor improvement? See the first goal of the Town as expressed on page 7 of the Comprehensive Community Plan attached as enclosure 8. (Please note the amendments dated February 21, 1978.) How and to what degree will the character of the Town be affected by increased commercial activity in the harbor? By increased highway traffic generated by increased harbor activity? How will the increased traffic affect highway safety? What time of year will this increased traffic take place and by what percentage? Will increased police protection be needed? Increased road maintainence? How much? To what degree will the harbor improvements affect the tax requirements of the Town? From road maintainence? Police protection? Will an improved harbor help preserve property values or cause them to deteriorate? Will the harbor improvements enhance Little Compton's attractiveness as a summer community? (The summer community is a*

Town of Little Compton
Rhode Island

HARBOR ADVISORY BOARD

significant economic asset to the Town, generating as it does business for its support and property tax income with no demand for school support).

There is a strong sentiment among some of those concerned with the proposed improvements that a full Environmental Impact Statement, the procedures for which require review by E.P.A. and not merely an Environmental Assessment, is needed. They have stated that they believe that fully answering questions which have been raised will actually accelerate the project rather than delay it, and that if the Corps were to decide to do an Assessment, rather than a full Environmental Impact Statement, the project would thereby be delayed for they would insist on an Environmental Impact Statement.

The Board is desirous that your study proceed through the points of decision in the most expeditious manner. It is the opinion of this Board that your environmental analysis should be as thorough as is reasonably possible; that it address fully and completely all the questions that have been raised other than those which are clearly the responsibility of local interests; that it should present clear evidence to support its conclusions with respect to environmental costs and benefits, if any, and that its credibility would be enhanced if the analyses were prepared by an independent firm with special qualifications in the subjects of concern. The following firms were discussed with some of those who attended the August 16 meeting as meeting the qualifications.

Lawler, Matursky and Skelly Engineers
Normandeau Associates
University of Rhode Island

If we can be of any further assistance to your office, as you develop your study, please call upon us. Our circumstances permit some time to examine your drafts and for this Board to submit comments as to whether we think the concerns mentioned herein, in the enclosures and in earlier communications have been treated adequately.

Please return the Comprehensive Community Plan as soon as it is convenient. It is my only copy and additional copies are not available.

Sincerely yours,

Harry Woodbury

Harry Woodbury

NORM ANDEAU ASSOCIATES, INC.
Nashua Road • Bedford, New Hampshire 0310 • (603) 472 510 • TWX 710 366 6468 ... FHH
ENVIRONMENTAL CONSULTING • RESEARCH • SERVICE

September 26 1978

Ref. No. 837-002

Mr. Joseph Ignazio
Chief, Planning Division
New England Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Ignazio:

In response to a meeting between members of your staff (Mr. Dave Dupee, Environmental Assessment Section, Mr. Tony Garone, Navigation Branch Section, and others) and members of this company at our facilities on September 20, 1978, Normandeau Associates, Inc. (NAI) is providing a recommended work scope for a thorough, yet reasonable, assessment of the environmental impact of proposed improvements for Sakonnet Harbor. Based upon our discussions the following concerns need to be addressed:

1. How will the proposed breakwater affect tidal flushing action within Sakonnet Harbor?

2. Will the proposed breakwater create adverse wave diffraction patterns to hamper boat traffic entering and exiting harbor?

3. Will modification in the size or orientation of the proposed breakwater significantly improve the modified flushing action, and/or the wave diffraction patterns.

To thoroughly address the above concerns, NAI recommends:

1. Literature review of existing physical and water quality data applicable to Sakonnet Harbor.

2. Application of a two-dimensional, computer-based, numerical, hydrodynamic model to predict water movements in the harbor as it presently exists.

3. Collection of field data to calibrate the model.

   a) A 15-day tide elevation study,

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24 Aviation Road • Albany, New York 12205 • (518) 458-1104

Mr. J. Ignazio
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Page 2

b) A current velocity measurement study at three stations within the harbor over one complete tidal cycle.

4. Case studies using model to; 1) predict the impact of the proposed breakwater on tidal flushing action within the harbor, and 2) to optimize the length and orientation of the breakwater with respect to flushing action.

5. Conduct a wave diffraction analysis to determine if proposed breakwater will hamper boat traffic.

6. Collect field data for input into wave diffraction analysis.

   a) Overflight during brisk SW winds to determine actual wave crest orientation off harbor entrance,

   b) Ground truth observations of wave period and height for day of overflight.

If you are in agreement with the above scope of work please notify us as such and NAI will prepare a technical and cost proposal to complete the work scope.

Sincerely yours,

NORMANDEAU ASSOCIATES, INC.

Thomas C. Shevenell
Thomas C. Shevenell
Physical Sciences Projects Manager

Peter R. Sapko, Ph.D.
Manager,
Physical Sciences Department

TCS:PRS:bw

THOMAS T. RICHMOND
CHARLES I. PIERCE, JR.
COUNSEL

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DOMINIQUE BLANCO
EUROPEAN COUNSEL

June 18, 1979

Col. John P. Chandler
Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02154

Sakonnet Harbor
<u>Little Compton, R. I.</u>

Dear John,

I understand you are coming down to Little Compton on June 27 to preside at the hearing concerning Sakonnet Harbor improvements. I am bitterly disappointed not to be there, but I simply cannot get off from New York on that Wednesday.

I will prepare a statement to be submitted at the meeting, which I hope Mr. David C. Goodrich will be allowed to read on my behalf.

Since this hearing is one of your last acts in your present post, as I understand it, I hope you will do everything in your power to assure that the unanswered questions concerning environmental impact are in fact answered. Many of us here have been sincerely trying to get <u>facts</u> concerning environmental impact, and as soon as we have those facts, we may have no further concerns or objections concerning the proposed new breakwater. But the process of getting at the critical facts seems to have been very slow.

In order that you will understand my own thinking, my concern is 99% a concern for preserving the present level

of water quality in Sakonnet Harbor. Enclosed is a copy of a letter I wrote to Normandeau Associates last October entitled "Statement of Environmental Concerns". You will note that the first set of questions deals with water quality. I might say that I had hoped that these questions would be answered more explicitly in either the Normandeau Report or the Corps' "Summary of Environmental Considerations", which I have just read.

The most important points I wish to make to you are these:

(1) Reoriented Breakwater. The Normandeau Report develops a "reoriented breakwater" design, which is like the two-breakwater design I proposed (see Appendix A to my "Statement of Environmental Concerns", referred to above) but with the two breakwaters connected by an angled connector. The Normandeau Report gives eloquent testimony as to the superiority of the "reoriented breakwater", in the form of various observations which I consider to be conclusive in favor of the reoriented breakwater as compared with other configurations. See paragraph 6 on page 2 ("Flow along the inside of the breakwater, which is important for flushing the harbor", is increased by 85% with the reoriented breakwater design) and paragraph 9 on page 2 ("Reorientation of the breakwater will negate any possible wave refraction.")

(a) The Corps' draft report totally ignores the Normandeau version of a reoriented breakwater, including the comments of Normandeau in favor of the reoriented breakwater design.

(b) The Corps' draft report refers, in the last "Q and A" on page 13, to the possibility, which we raised, of changing the angle of the breakwater, but then fails to offer a real analysis of the advantages and disadvantages. This is in spite of the various comments in the Normandeau Report about changing the angle of the breakwater (or adopting the "reoriented breakwater"). It seems to me that changing the angle of the breakwater, combined with shortening it to 600 feet, is probably the most desirable form of the breakwater proposal, and I urge that it be fully discussed.

(2) Discussion of Water Quality. The discussion in Section 3.33, on page 11 of the Corps' draft report, seems to me to be unacceptably skimpy. I cannot say precisely how I think Section 3.33 should be expanded and revised until I have talked to the Normandeau people and obtained answers to a great many questions and comments which I am raising with them. My biggest problem with Section 3.33 is that it does not describe what the flushing effect of the tidal cycle is in Sakonnet Harbor today and then deal precisely with the changes which a breakwater would cause, as predicted by Normandeau. The fault is not entirely that of the Corps, because the Normandeau report also does not state clearly and simply whether the proposed breakwater (in the three different configurations they discuss) will reduce or increase the flushing effect of the tidal cycle.

I have some other specific criticisms of Section 3.33, but I shall reserve them for my enclosed commentary on the Corps' draft report. I propose to phone either Mr. William McCarthy or Mr. Gilbert Chase to see how I can best get answers to these questions, and I am sending both Mr. McCarthy and Mr. Chase a copy of this letter.

I am also enclosing a copy of my letter to Dr. Normandeau and my questions and comments on the Normandeau report.

Again, I will be very sorry not to see you in Little Compton.

With best wishes for a happy and rewarding time in your next endeavor.

Sincerely yours,

Roswell B. Parkins

Enclosures

cc: Mr. William McCarthy
Mr. Gilbert Chase
Dr. Donald Normandeau

Town of Little Compton
Rhode Island
HARBOR ADVISORY BOARD

June 27, 1979

Technical comments of the Harbor Advisory Board at the public hearing of the Army Corps of Engineers on proposed improvements to Sakonnet Harbor.

Colonel Chandler: My name is Harry Woodbury. I am Chairman of the Harbor Advisory Board of Little Compton. Our role is to advise the Town Council on all matters having to do with the development and management of Sakonnet Harbor. The Board consists of nine members and includes fishermen and yachtsmen operating from Sakonnet Harbor, owners of residential and commercial properties fronting on the harbor, and citizens of the Town having a general interest in the Town. This statement is filed on behalf of the Board.

First, I wish to express the appreciation of the Board for the cooperation extended to it by your office and your contractors Archibald and Normandeau who have assisted in the development of your economic and environmental studies of the feasability of improving our harbor. Cooperation has been the hallmark of our relationship with your efforts since the study began in November of 1976. It is our hope that now you can rapidly conclude your report, so that the Town at an early date, will have the information on which to make its decisions on whether or not to proceed with a project. And if the Town decides to proceed with a project, then whether to do so under Section 107 of the 1960 River & Harbor Act as amended or under the survey report procedures established by the River and Harbor Act of 1936 as amended.

Project formation: We have studied the material which you have made available prior to this meeting. It includes the "Social and Economics Effects Assessment", the "Summary of Environmental Considerations" and the "Hydrographic Analysis" by Normandeau. We are unable to ascertain from our study the basis for your formulation of the project as it relates to the orientation of the breakwater. We asked that you examine three alternatives: a 750' breakwater oriented at about 45° east, extending to the large rock off-shore from the Milliken's residence, one on that same alignment but shortened on its east end to 600 feet and a third 600 feet long oriented about 30 degrees east. Mr. Roswell Perkins, we understand, asked you to investigate a fourth alternative of splitting the third alternative into two 300 foot breakwaters, offset, to permit additional flushing of the harbor. Our interests in comparing these alternatives are in five categories: relative influence on waves and floating frazzle ice collection in the harbor, relative effect on water velocities in the harbor entrance as they may effect boat movements, relative effect on water quality in the harbor, relation to physical interference with the trap-set of H.W. Wilcox just north of the harbor and relative costs. We are unable from the material thus far available to evaluate adequately these alternatives or to fully comprehend the influence of your selected alternative on our five categories of interest. We would appreciate an opportunity to meet with your engineering and environmental people and personnel of your contractors to obtain a better understanding of your analysis.

Layout: Mooring space in Sakonnet Harbor is at a premium. We are desireous of maintaining as large a mooring area as is reasonably possible. Accordingly, we would like to see the northwest boundary of the new 10 foot channel as close along the breakwater as possible without endangering the stability of the breakwater. The west boundary we would like to see coincide with the present project boundary.

Further, while the large turning basin at the south end of the channel is beneficial, the costs in mooring space seems to us to be greater than the benefits. We therefore suggest elimination of the turning basin. We would prefer that you only extend the 110 foot channel to the south project boundary. This will restore about 1-1/2 acres of prime mooring space. It will also reduce substantially the total amount of dredging necessary by both the Corps and local interests and thus reduce the total cost of the project.

Construction Methods: In our original submission to your office requesting this study, we stipulated that the plan should require bringing the rock to the construction site by barge and placing it from barges. Archibalds submission clearly reflected that stipulation. The material furnished by your office in advance of this meeting appears to have overlooked that stipulation.

Benefits: The economic benefits which you ascribe to the project, while adequate for a very favorable benefit/cost ratio, seem very modest. We see the project as creating substantially greater economic benefits:

1. The project will prevent deterioration of our present fishing industry by permitting it to modernize operating over a longer season. This constitutes damage prevented and thus a

at Sakonnet Harbor since 1971. The Sea Clam landings in 1978, reported by NOAA, were actually landed in Tiverton. Quahoging operations from Sakonnet could start as soon as the breakwater is built and amount to at least 100,000 bushels a year.

3. With an improved harbor and harbor facilities we would expect to see significant increases in swordfish landings during the life of the project.

4. The projected increase in lobster landings is only four percent over the landings in 1976, and is about equal to the projection of 15,000 pounds made in your 1969 report. The 1969 projection was low by more than an order of magnitude. With a better harbor, improved shore facilities, modern multiple purpose fishing boats we anticipate an increase of at least 100,000 pounds; the principle limiting factor being the offshore lobster population and future regulations pertaining to it.

5. Unit price of fish: The increase in landings of fish in the winter time will first be from gill net fishing. The average price brought by winter landings of cod varied from a low of \$ 0.25 to a high of \$1.05, and averaged better than \$.60. The gill net fishing can be expected to be supplemented with trawling and long line fishing. The unit price of \$.30 used in your report seems conservative as does the projected increase in landings.

6. Harbor of Refuge: No economic benefits were ascribed to the project as an improved harbor of refuge.

7. Maintain population balance: A primary goal of Little Compton's Comprehensive Community Plan is to preserve the present character of the Town. That includes not only the fishing industry

for accomodating recreational craft in the harbor, thus maintaining one of the significant attractions for summer residents. While it is understood that such benefits are secondary and cannot be counted in your benefit/cost ratio, they are nevertheless important to the Town and its residents and suggests a significant consideration in your evaluation of the effect on property values.

Costs: The project cost estimate will be the principle consideration of the Town in providing local assurances. It is our understanding that your office will make that cost estimate following further subsurface exploration, engineering design and the preparation of contract, plans and specifications. We further understand that you will do so by next winter. We certainly hope it will be well before the annual Financial Town Meeting, which takes place on the first Tuesday in April. At that time, the Board expects to consider the financial obligation the project could impose on the Town and recommend to the Council whether to proceed under Section 107 of the 1960 River & Harbor Act, as amended, or change to the survey report procedure.

We understand the Council can expect, in fact, to be able to make the final determination on assurances under 107, after bids are opened and the pre-award construction work estimate has been prepared. Obviously, the financial risk to the Town would be reduced by using a lump sum fixed price contract on breakwater construction and we would hope you would select this type contract. Should unforeseen conditions develop during the construction of the project that might cause an unforeseen financial obligation to the Town, the Town should be consulted concerning its financial obligation prior to the issuance of any change order. For example, your subsurface probes suggest there is no rock within the channal

lines that would have to be blasted out to provide the 10 foot channel 110 feet wide. We understand your preliminary estimate for dredging costs is based on no rock excavation. Should your dredging contractor encounter rock, (and we think he may east of the Fo'c's'le), we want to be consulted before you permit the contractor to proceed with the rock excavation, if by proce[illegible] he is liable to incur an obligation of the Town. At that time, we would like to be able to decide to reduce the channel width to 60 feet through the rock sections or even to omit excavation of the ledge.

All of this was discussed in detail with Mr. Archibald. Our discussion is reflected in the apparent inconsistency in your public notice, which calls for 110 foot channel, but shows only 60 feet being excavated east of the Fo'c's'le.

We understand that the contract for the dredging will follow by a year or so the contract for the breakwater. If prior to awarding the contract for dredging, it should develop that the total project costs might exceed the statutory limit on federal costs, we could then choose to reduce those costs, by deleting the dredging, Plan A having a favorable B/C ratio.

It may be that our concern over the uncertainty of the Town's obligation under Section 107 will be substantially relieved. We are advised that the current omnibus bill contains a provision to raise the small projects limitation on federal expenditures under section 107, from two to five million dollars. We would hope that change is passed by the Congress and becomes law this year.

The Board hopes that your office will proceed as expeditiously as you can to the point where we can make an analysis of financial implications and submit our recommendation to the Council.

DEBEVOISE, PLIMPTON, LYONS & GATES
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July 31, 1979

Mr. William McCarthy
Chief, Environmental
Analysis Branch
Department of the Army
Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Mass. 02154

Sakonnet Harbor
<u>Little Compton, R. I.</u>

Dear Bill,

This is a follow-up on the July 9 "workshop" in Little Compton, and merely sets down some of the matters I stated orally.

(1) I think that, in view of the fact the Normandeau Report dealt with only two configurations which it found acceptable from the water quality standpoint, the Corps must not promote a configuration which is less acceptable from the water quality standpoint.

(a) The two Normandeau configurations were the 540-foot breakwater at 062° true and the reoriented breakwater (about 042°?) of a length of some 600 feet.

(b) My own strong preference would be both reoriented and shortened to 540 feet or less.

(c) I believe the 600-foot, non-reoriented breakwater would be legally vulnerable, since the Normandeau Report did not deal with it.

(2) I think the Corps should do the necessary studies for the reoriented breakwater, namely, (a) to take accurate soundings where the breakwater would be located if the west end remained in the same position as in the proposal of the Corps, and (b) to ascertain how the anchors to Tony Parascandola's fish trap leader could be taken care of (such as permitting a connection to the base of the breakwater).

(3) As to length, I have made visual sights from the end of the Yacht Club dock and have concluded that a breakwater would provide ample protection even if it extended no further east than the point of intersection of a straight line drawn from the end of the Yacht Club dock to the tangent of Church's Point (just north of Taylor's Lane). I would appreciate your calculating the length of such a breakwater.

(4) Since there must be an opening between the east end of the breakwater and shore which provides a volume of flow at least equal to that permitted by the 540-foot or reoriented breakwater (see the drawings of the "profile" of the opening in the Normandeau Report), there will necessarily be an opening through which ice conceivably can work its way. The point is that an alternative means of fighting the ice, if it does continue to be a problem (which I very much doubt), will have to be found. There are many of us who will be glad to work to find that solution.

I will be glad to talk with you further.

Sincerely yours,

Rod Perkins

Roswell B. Perkins

cc: Mr. Thomas Shevenell
Normandeau Associates

Town of Little Compton
Rhode Island

nclosure 3.
Ltr to Colonel Scheider 2 Jan 80

December 28, 1979

The Honorable Guido J. Canmulla
67 Bourne Avenue
Tiverton, Rhode Island 02878

Dear John,

At the request of the Town of Little Compton and by authority of U. S. Senate and House Resolutions of May and September 1976, the U. S. Army, Corps of Engineers, New England Division has been studying the feasibility of improving Sakonnet Harbor. In 1978 you facilitated our effort by sponsoring legislation in the Rhode Island legislature.

The Corps of Engineers has concluded that improving Sakonnet Harbor for commercial fishing is economically and environmentally feasible. The improvement they have recommended consists of a 550 foot northerly breakwater to render the harbor useable as a year round fishing port and to deepen a channel along the west side from 8 to 10 feet to permit its use by modern 65 foot multiple purpose fishing boats. The Corps of Engineers recommends proceeding with construction under Section 107 of the Rivers and Harbor Act of 1960 as amended. To do so requires non-federal interest to:

1) Be responsible for the continued operation and maintenance of an adequate public landing for the sale of fuel, lubricants, and drinking water to all on an equal basis;

2) Provide all necessary lands, easements and rights of way for construction and subsequent maintenance of the project, including dyked disposal areas for dredged materials;

3) Provide and maintain berths and other mooring facilities for local and transient vessels as well as access roads, parking lots and other required public use shore facilities open and available to all on an equal basis;

4) Establish regulations prohibiting the discharge of untreated sewage and other pollutants into the waters of Sakonnet Harbor;

5) Hold and save the United States free from damages that may result from the construction and maintenance of the project;and

6) Assume responsibility in all project cost in excess of $2,000,000.

These latter two are standard boiler plate assurances derived from the provisions of Section 107 of the Rivers and Harbors Act.

The Town of Little Compton is able and expects to provide the assurances 1 thru 4 above. Assurances 5 and 6 are believed by our Solicitor, Mr. Alfred Stapleton, beyond the authority of the Town. Accordingly the Town asked the Department of Environmental Management to provide these two assurances in a manner similar to the assurances provided on other federal navigation projects such as, most recently, Galilee. Mr. Daniel Prentiss, Attorney for D.E.M., has advised Harry Woodbury, Chairman of the Harbor Advisory Board, that while D.E.M. is prepared to support the project, for them to provide assurances 5 and 6 requires legislation.

The Town Council requests that you obtain for the Town, in this next legislative session, whatever legistation is necessary to enable the Governor or his designee, to provide the U. S. Army Corps of Engineers assurance that the State will:

1) Hold and save the United States free from damages that may result from the construction and maintenance of the project, and

2) Assume responsibility for all cost in excess of $2,000,000.

The financial risks to the State in providing th[illegible]ssurances are small indeed:

1) Sakonnet Harbor has existed as a Federal Project since 1936. The non-federal obligation to hold the United States free from damages has existed for years. We are aware of no claim for damages having been sustained arising out of previous federal harbor improvement projects and do not expect any from this further improvement.

2) The current working estmate of the Army Engineers for this improvement is $1,489,000 including a 15 percent contingency allowance. For the project costs to exceed $2,000.000 the construction costs would need to over-run more than 34 percent or, if the 15 percent contingency is removed from the estimate, by 54 percent. The likeihood of such an over-run can best be evaluated in the light of the previous over-run experience of the New England Division Corps of Engineers on small navigation projects. The Division Engineer provided a summary of their experience on all small navigation projects in New England since 1960. A copy of that summary is attached. Please note that, for Section 107 projects, the average has been a 27 percent under-run and the only over-run was Hampton Harbor, Maine of 21.2 percent on a $325,000 project. Even on specifically authorized navigation projects that normally take many more years between the time of original cost estimate and final completion the greatest over run was only 16 percent and the weighted average under-run 3.4 percent.

Messrs Harry Woodbury, Chairman of our Harbor Board, and Alfred Stapleton, Town Solicitor, stand ready to assist you in drafting the legislation, to appear as witnesses before appropriate committees, and to serve as liaison between

Town of Little Compton
Rhode Island

the Town and the Legislature and/or the Governor or his designee.

Thank you for your help.

Sincerely,

Jane P. Calvert

President, Town Council

C.C. S. Rowland Morgan, RI. House of Representatives
R. Daniel Prentiss, Attorney, Department of Environmental Management
John Lyons, Chairman, Coastal Resources Management Council
Division Engineer, U.S. Army Corps of Engineers
Alfred B. Stapleton, Town Solicitor
Harry G. Woodbury, Chairman, Harbor Advisory Board
File

Habor Advisory Board
Little Compton Rhode Island

2 January 1980

Colonel Max B. Scheider
Division Engineer, United States Army
424 Trapello Road
Waltham, Massachusetts

Dear Colonel Scheider,

Responding to the invitation of your planning staff, I have informally reviewed the December 1979 draft of the Detailled Project Report (DPR) on Sakonnet Harbor and submit my suggestions for your consideration. See enclosures 1 and 2. Similarly I will review the appendices when received. The comments are principally editorial except as they relate to non-federal responsibility. I regret that the project engineer is leaving your service before this report is brought to fruition. Please extend to him our appreciation for his interest and cooperation over the past four years.

At enclosure 3 is a copy of a letter from our Council to our State Senator seeking legislative authorization for the Governor to provide the assurance your staff is insisting upon: ie, to assume all costs over two million dollars. This letter became necessary after our Department of Enviromental Management advised us that no State agency had authority to provide the assurance you are requiring.

Obtaining special legislation for this authorization is far from assured.

(1) The requirement is unprecedented in Rhode Island.
(2) To ask the legislature to authorize an open end no ceiling contract in which neither the State nor any agent thereof has any authority to control costs is to require the State to engage in a business practice that is not condoned by the U. S. Congress. They always place dollar limits on their authorization and rigidly enforce those limits.
(3) Section 107 of the Rivers and Harbors Act simply limits the expenditures the Corps can make on any project, a matter wholly within your control. I can find in the law no requirement for non-federal interests to agree to assume all costs over two million dollars. That requirement appears to be an administrative determination which in fact could serve to reduce any inducement the Corps might have to keep costs below $2,000,000.
(4) In the case of the recent Point Judith project your DPR contains no requirement that the State assume responsibility for any costs you might incur over $2,000,000. Similarly your files contain examples of other projects in other states for which you required no assurance that non-federal interests assume costs over the legislative limit.

None of this makes a very convincing case that special legislation is in fact necessary.

Even if we are successful in obtaining special legislation obligating the State to an unspecified unlimited expenditure at some indefinite time in the future when a new legislature will have jurisdiction, the legal sufficiency of such legislation could surely be questioned.

I urge that you reconsider this contract requirement of non-federal responsibility and, following the practice you followed on Point Judith, delete it from your report.

Sincerely yours,

Harry G. Woodbury

Harry G. Woodbury

Enclosures: 3 a/s

JAN 80

NEDPL-C

Major General Harry G. Woodbury, U.S. Army Retired
Chairman, Harbor Advisory Board
Little Compton, RI 02837

Dear General Woodbury:

Reference is made to our meeting of 7 January 1980 and follow-up telephone conversations regarding those assurances which are required prior to project implementation. Through discussions with my staff, the following information has been compiled for your use.

The United States Code, Title 33 on Navigation and Navigable Waters, empowers the Chief of Engineers to require any and all assurances which he may deem appropriate. Chapter 12 of Title 33 entitled "River and Harbor Improvements Generally," Section 577 paragraph (c) states:

> "Local interests shall provide without cost to the United States all necessary lands, easements and rights-of-way for all projects to be constructed under the authority of this section. In addition, local interests may be required to hold and save the United States free from damages that may result from the construction and maintenance of the project and may be required to provide such additional local cooperation as the Chief of Engineers deems appropriate. A State, county, municipality or other responsible local entity shall give assurance satisfactory to the Chief of Engineers that such conditions of cooperation as are required will be accomplished."

The Chief of Engineers in performance of his duties has determined that as referenced in ER 1105-2-50, Paragraph 6(5), local interests must agree to assume responsibility "for all project costs in excess

NEDPL-C
Major General Harry C. Woodbury, U.S. Army Retired

of the specified Corps cost limitation." This assurance was developed to insure that project eligibility is maintained as stipulated under the basic Program Eligibility Requirements, referenced in ER 1105-2-50 paragraph 5 which reads, "Any project recommended must be justified under established Federal planning criteria, must be complete in itself and must not obligate the Federal government to future work except for those cases in which maintenance by the Federal government is provided by applicable provisions of general law."

My staff has interpreted the above statements to mean, and I concur, that to prevent any navigation improvements from being only partially constructed in the event construction costs are greater than the $2,000,000 limitation, the local sponsor must assume the financial responsibility in excess of said limitation. Therefore, it has been determined that this office has the proper authority to require any and all assurances it deems appropriate, and that they be furnished by the local sponsor prior to project implementation.

In response to your concern over the lack of authority for the town council to sign such assurances, thereby committing future town councils to a prior financial obligation, I would like to offer the following information.

The city of Providence, on 16 August 1960, signed assurances for construction of the Fox Point Hurricane Protection Barrier, committing the city to "contribute 20 percent of the first cost of the project, said 20% presently estimated at ...".

The State of Rhode Island, on 10 November 1969, committed the state, for construction of the Fox Point Hurricane Protection Barrier, to "contribute 10% of the first cost of the project, said 10% being presently estimated at . . ."

The city of Woonsocket, on 7 May 1963, signed assurances for construction of the Blackstone River Flood Control Project, committing the city to "contribute in [illegible] 16.1% of the cost of the work to be accomplished . . . the fin[illegible] allocation of cost to be made after the actual costs have been det[illegible]ned."

The city of Warwick, on 27 September 1965, signed assurances for construction of the Warwick Cove Navigation Project, committing the city to "assume full responsibility for all project costs in excess of the $200,000 Corps of Engineers cost limitation under Section 107 of the 1960 Rivers and Harbors Act at that time, to contribute in cash its proportional share of the total required cash contribution

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of 50 percent of the first cost of construction of the general navigation facilities;".

The city of Newport, on 14 March 1970, signed assurances for construction of the Cliff Walk Beach Erosion Control Project, committing the city to "contribute 58.2 percent of the estimated first cost of construction . . . the actual local contribution of first cost to be based on actual construction costs . . ."

In addition to the above examples, the General Laws of Rhode Island, Title 46, Chapter 2, Section 46-2-2 states, "The director of environmental management is authorized to negotiate, cooperate and enter into agreements in behalf of this state (Rhode Island) with the United States of America in order to satisfy the conditions imposed by the United States of America authorizing any project for the improvement of navigation of any harbor or river . . . provided such project shall first have been approved by the governor."

Title 46, Chapter 2, Section 46-2-3 states, "The director of environmental management, with the approval of the governor, is authorized to give assurances that the state will hold and save the United States of America harmless from claims and damages resulting from any such improvement or protection project and to enter into any agreement with the Federal government for such purpose."

Title 46 Section 46-2-7 states, "Any city or town is authorized to negotiate, cooperate and enter into agreements with the United States of America and the state in order to satisfy the conditions imposed by the United States of America in authorizing any project for the improvement of navigation . . . provided such project shall have been approved by the governor."

Title 46 Section 46-2-10 states, "The town council of any town . . . are authorized to give assurances that the respective town . . . will hold and save the United States of America harmless from claims and damages resulting from any such improvement . . . and to enter into agreement with the United States of America for such purposes."

Based on the above historical examples and the appropriate state laws, precedents have been established which would enable the town of Little Compton to comply with any and all reasonable assurances which this office deems appropriate. However, should the town decide that the (potential) financial commitment may be excessive, this office could redirect the Section 107 study to the Congressional Survey route.

3-42

NEDPL-C
Major General Harry G. Woodbury, U.S. Army Retired

Should the Congressional route be chosen, a significant delay will occur, as each juncture of the project's progress requires specific action by Congress. I have inclosed for your use one copy of a flow chart entitled "Relationship of the Planning Milestones to the Appropriation Cycle." In reference to the chart, the Sakonnet Harbor investigation is at the October year 5 stage. Assuming the document proceeds in an expeditious manner, up to 10 years could be required to initiate construction. A means of substantially shortening this 10 year route could be through the use of Section 201 of the 1970 Rivers and Harbors Act. The Sakonnet project falls well within this Section's application.

Authorization under this authority, requires approval by the appropriate committees in both Houses of Congress. The major impediment to this course of action is the President's Water Policy proposal of 1978 which would require that the state provide a five percent mandatory contribution of the estimated first cost of construction. As the Water Policy proposal has failed to receive Congressional approval, nor does it appear to be readily forthcoming, no projects have recently been authorized under Section 201.

I hope that this information will assist you and the town in making the final decision as to what is deemed the most appropriate course of action. Should you require further data, please do not hesitate to contact me.

Sincerely,

Incl
as stated

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

cc: Mr. Frechette - Real Estate
Mr. McCulloch - Division Counsel
Reading File
Planning Division File

DEBEVOISE, PLIMPTON, LYONS & GATES

299 PARK AVENUE NEW YORK, N.Y. 10017
TELEPHONE: (212) 752-6400
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INTERNATIONAL TELEX: 234400 DOMESTIC TELEX: 12-6807

March 18, 1980

General Harry Woodbury
Warren's Point Road
Little Compton
Rhode Island 02837

Sakonnet Harbor

Dear Harry:

Many thanks for your note of March 3, 1980 and the enclosed "Review Draft" of the new Report of the Corps. It only arrived a couple of days ago, and I am writing this at home on my back (laid up with a bad back) without benefit of any of my files and without even a copy of the earlier Corps Report.

Thus, I must reserve the right to make more detailed comments later, but I will get these off to you without further delay.

1. General

The Report is a vast improvement, technically and from the standpoint of integrity. For example, instead of a lot of conjured-up talk about 6 new trawlers, it simply rests on the broad proposition of better protection of the harbor in winter. Another example: it does not make false claims to a great increase in moorings.

2. Water Quality: General

I am gratified that the Report for the first time shows sensitivity to the matter of water quality, and it clearly pays considerable attention to the results of the Normandeau study.

3. A Detail: The Plan Drawing at the Back

Please, for the umpteenth time, may I strenuously urge the elimination of the line labelled "limit of existing anchorage" and the legend "new mooring area for recreational boats." THESE ARE INACCURATE AND MISLEADING. I pointed out at the hearing at the Town Hall in August of 1978 that any crude sighting from the Morton's house shows that many boats are moored outside the line labelled "limit of existing anchorage". Why have a diagram which is patently false to anyone who knows the harbor?

Similarly, I have been pointing out for 1-1/2 years that the area labelled "New Mooring Area for Recreational Craft" is falsely labelled for two reasons:

(a) there are already many craft in this area; and

(b) the breakwater will do nothing to enlarge the area, since the only limit on use of this area today is exposure to southwest winds. This exposure will continue.*

I hate to see the Corps' diagram patently vulnerable on its face. Therefore, the line labelled "limit of existing anchorage" should either be moved substantially to the north or, preferably, eliminated. The label "New Mooring Area for Recreational Boats" should be eliminated or changed to:

"Area for Possible Increase in Moorings for Recreational Boats."

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* This point is more or less conceded on page 16, in the third paragraph under "Evaluation and Trade-Off Analysis."

I cannot understand why the Corps has not listened to these comments when presented twice before orally and also in writing.

4. Important Terminology: Pages 33 and 34

At the bottom of page 33 and the top of page 34 the writers of the Report have adopted labels for the three breakwater configurations which came out of the Normandeau Report and which should be changed for reasons of clarity and in order to accord with the terminology of this new Corps Report. The most glaring error is that the word "proposed" in the Normandeau Report meant the 750-foot breakwater, and the word "proposed" must not be used in this new Report except in relation to the 550-foot version.

My recommendations for rewriting the bottom paragraph on page 33 and the two paragraphs at the top of page 44 are as follows (with the new language underscored to identify it, but not to remain underscored in the final version):

> "There would be about 100,000 m^3 flow through the west inlet with this longer 750-foot breakwater (Plan A). The flow would be increased by 50% should the breakwater be shortened (Plan B). All of the increased flow would move out of the North Inlet. Reorienting the breakwater as in Plan C would increase the flow by 85%, as most of the water would move out through the North Inlet.
>
> The cross-sectional area of the North Inlet changes with each breakwater configuration. The area for the inlet with the shortened (Plan B) and reoriented breakwater (Plan C) is about three times the area of the inlet with the 750-foot or Plan A breakwater. It is interesting to note that although the inlets for the shortened (Plan B) and reoriented (Plan C) breakwaters have the same cross-sectional areas, the reoriented breakwater (Plan C) allows a greater volume of water to pass through the inlet. This increased volume of water afforded by the reoriented breakwater would, however, also permit a possible increase in the amount of ice transported into the harbor.

> For the harbor under existing conditions the model predicted a tidal prism of approximately 60 to 70,000 m^3 of water which passes the harbor transect. This volume will not change as a result of breakwater construction. Flow through the north inlet would be limited by construction of the 750-foot breakwater. But flow will increase by about three times if the breakwater is shortened as in Plan B and by about four times if the breakwater is reoriented as in Plan C. The biggest trade-off with the reoriented structure (Plan C) is in terms of possible ice accumulation versus flushing and economics."

5. Evaluation of Increased Flow Through North Inlet

The paragraph at the bottom of page 33 rather casually dusts off the difference between a 50% increase in flow versus an 85% increase in flow through the North Inlet. This is an enormous difference which favors Plan C. I believe that the Report should place a much greater degree of significance on this huge difference between Plans B and C from the water quality standpoint.

I recognize that a reasonable person could reach the ultimate conclusion favoring Plan B, on the theory that surface wind action (according to the Normandeau Report) has more to do with water quality than the underwater currents. However, the reader should understand, and the Report shoul say so very explicitly, that the 85% flow factor is a very stron argument for Plan C.

6. Ice

The point has been made many times by others, and is conceded at the top of page 16 of the Report, that the ice flow after a north breakwater has been installed is wholly unpredictable. Thus, the Report should never say that Plan C would increase the ice in the harbor as compared with Plans A or B. The absolute most that can be said is that the "potential" for ice may be greater under Plan C as is stated at the top of page 16 (first full paragraph).

Also, nothing has been said about the use of a chain of logs or rubber tires across the North Inlet to impede ice flow under Plans B and C, which I believe is entirely feasible.

7. Table 3: "System of Accounts"

There is a line "D. Public Response", in the table which follows page 22. The subhead says "Plan Found Acceptable". Under Plan C is the notation "NO".

My question is this: who says that Plan C is unacceptable to the public? I know of no poll or other sampling of opinion which says that Plan C was disfavored.

This line should be completely eliminated, in my judgment, unless someone can show me an objective poll that was taken which clearly presented to the persons being polled the differences between Plan C and the other plans.

* * *

As is obvious, I favor Plan C because of the 85% additional flow factor referred to above, which is derived from the Normandeau Report.* However, I told Dick Rogers and you last summer that, if the Town were to adopt very stringent water pollution control measures and if the fishermen were to subscribe to these, I would not oppose the 540-foot breakwater which was the "shortened" breakwater analyzed in the Normandeau Report.

I do not know how the Corps happened to move from the 540-foot breakwater analyzed in the Normandeau Report to the 550-foot breakwater which is "Plan B", and I was upset that there was any lengthening whatsoever. While 10 feet may be relatively insignificant, if there is even an additional foot of further lengthening of the proposed breakwater I will consider myself released from the expression of support I made to Dick Rogers and to you. My position would then be that a new water quality study is necessary, since the Normandeau Report only addressed itself to three models: the

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* If the extra costs are to be paid by the Federal Government as a result of a "line item", I think we should go for Plan C. The extra cost would be well worth it.

750-foot version, the 540-foot version and the reoriented (20°) 600-foot version. If a new water quality study is needed, we will then face further delays--which would clearly not be in the best interests of the project.

I truly hope the present Review Draft will be revised to take the foregoing comments into account. The new draft is an enormous improvement, partly because it takes into account the Normandeau Report (which I shall always maintain was a very essential study). Let's finish the job by making the final report both accurate and truly credible, so that the only remaining issues will be financial.

Also, I would hope that the Harbor Board has drafted a set of very stringent water pollution control regulations which can be issued for comment by everyone in a draft form.

With best regards,

Sincerely yours,

Rod

Roswell B. Perkins

P.S. I am sending a copy of this letter directly to the Division Engineer of the Corps, since time must be short. I am returning your copy of the Report to you.

cc: Division Engineer
New England Division
Corps of Engineers, U.S.A.
Trapelo Road
Waltham, Mass. 02154

11 JUL 1980

NEDPL-C

Colonel Alfred B. Devereaux, Jr.
Commander and Director
U.S. Army Cold Regions Research
and Engineering Laboratory
P.O. Box 282
Hanover, NH 03755

Dear Colonel Devereaux:

This office is presently conducting a water resource improvement study for Sakonnet Harbor, Little Compton, Rhode Island. Analyses have indicated, as shown on the attached map, that navigation improvements consisting of an access channel 10 feet deep at mlw for a width of 110 feet and a rubble mound breakwater 500 feet long would enable the existing commercial fishing fleet to utilize the harbor on a year-round basis.

The proposed breakwater would protect the harbor from wind generated waves originating in the north-northwest. For purposes of water quality, however, it was necessary to allow for maximum flushing action while still assuring protection against the design wave of 5 feet. In recognition of this potential detrimental environmental impact, it was necessary to allow for a 450-foot opening on the northeast corner of the harbor between the shoreline and breakwater.

At a recent meeting with local interests, concern was raised that the 450-foot opening east of the proposed breakwater would allow for free movement of ice floes into the harbor and result in the accretion of ice at the head of the harbor.

In an attempt to provide the best possible navigation project for Little Compton, this office is desirous of ascertaining the severity and potential impacts of ice floes in Sakonnet Harbor. Therefore,

Mr. Andon/jlc/550

NEDPL-C
Colonel Alfred B. Devereaux, Jr.

I would like to request that a member of your staff be made available to meet with my staff and visit the project site. It is hoped that this visit will assist this office in reaching a prompt and technically sound solution to this problem.

Should you have any questions, please feel free to contact me at 894-2400, extension 220. Mr. Andon of my staff coordinated the investigation. I would appreciate your staff contacting him at the earliest possible date to arrange the meeting. Mr. Andon can be reached at extension 550.

Sincerely,

Incl
As stated

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

cc: Executive Office
Coastal Dev. Br.
Reading File
Planning Div. File

DEPARTMENT OF THE ARMY
COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, CORPS OF ENGINEERS
HANOVER, NEW HAMPSHIRE 03755

CRREL-EI

18 August 1980

Mr. Steve Andon
NEDPL-C
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Steve:

Enclosed is a Memo for Record giving our opinions on the ice problem at Sakonnet Harbor, RI. I hope this answers your questions and is sufficient to allow you to continue with the project.

Mathematical models are available to predict wind induced ice movement but the time constraints on your job and the apparent simplicity of the problem indicate that such an effort would not be worthwhile.

While we were visiting at Sakonnet the problem of piles lifting out due to ice action was mentioned. We have done some work on this problem in the Great Lakes and have some economical suggested fixes which you could mention during your next visit. Len Zabilansky (Ext. 319) has done this work and will have a report out this year. Meanwhile you might call him.

Thanks for calling us on this job and hope we can be of help again.

Sincerely,

Steve Den Hartog

STEPHEN L. DEN HARTOG
Geologist
Ice Engineering Research Branch

1 Encl
As stated

August 1980

MEMO FOR RECORD

Sakonnet Harbor, RI

Introduction

On 29 July 1980 Messrs. Deck and DenHartog and Prof. Maattanen visited Sakonnet Harbor, RI with Steve Andon and Bob MacDonald of NED. We talked with MG Harry Woodbury (retired) and two local commercial fishermen, one of whom is also the harbor master. We were given a good description of the existing ice conditions and shown a number of good, revealing photographs. Short of a multi-visit, two or three season observation program we got as good a feel for the present ice problems as possible.

Site Description and Problem

Sakonnet Harbor is located about 8 miles east of Newport, RI and about 15 miles south of Fall River, MA. The Harbor opens to the north and is completely protected from the Atlantic Ocean. However, the Harbor opens to the northwest and is exposed to wave action from a long reach of Sakonnet River estuary. To minimize wave action in the Harbor and still maintain water quality, a detached breakwater has been proposed. We have been asked to give our opinion on the effect of this proposed breakwater on ice conditions in the Harbor.

Discussion

Discussion and observation of the photos exhibited during our visit indicate that Sakonnet Harbor has an ice problem nearly every year but usually of short duration and not sufficient to cause dock or boat damage. On some occasions, however, the Harbor has had sufficient ice cover to preclude movement of the fishing boats for up to two weeks. The ice formation is primarily the result of mush ice, carried

into the Harbor by a northwest wind, which freezes in place during a cold spell. This ice remains until either warm (above freezing) weather or strong southeast winds occur. Mush ice consists of small baseball-sized chunks of ice primarily formed by high winds over open water. Although no figures were given us on the thickness of the ice cover, it is conceivable that the mush could pack to depths of up to two feet and then freeze together.

The Normandeau Associates, Inc. May 1979 study indicates tidal surface currents with the proposed "shortened" breakwater will be more or less similar to what they are now although faster in some areas and slower in other areas of the Harbor. We don't believe that changes in tidal action caused by the new breakwater will appreciably affect ice in the Harbor.

Ice driven by a northwest wind will enter the Harbor through the gap at the northeast end of the breakwater. The breakwater as proposed will not reduce the amount of ice entering the Harbor with this wind but the reduced wave action should lessen the pushing and thickness of the ice at the beach end of the Harbor making it easier to break out by the fishing boats. However, due to less wave action mush ice freezing together will increase.

The southeast winds which flush the Harbor of surface flotsam and ice should be as effective with the breakwater as they are without it.

Since the breakwater will effectively calm the Harbor we should expect additional fast ice (regular grown in place ice attached to shore). However, due to the relatively warm climate of the area this ice should not reach a thickness sufficient to stop the fishing vessels more often than does the present mush ice situation.

Conclusion

The ice problems that presently exist at Sakonnet Harbor will continue to occur after the construction of the proposed shortened breakwater. We do not believe they will be changed appreciably one way or the other by the construction of this project.

DAVID S. DECK
Research Hydraulic Engineer
Ice Engineering Research Branch

STEPHEN L. DEN HARTOG
Geologist
Ice Engineering Research Branch

MAURI MAATTANEN
Visiting Professor

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INTERNATIONAL TELEX 234400 DOMESTIC TELEX 12-6607

December 4, 1980

Harbor Advisory Board
Little Compton, R. I. 02837

Attention: Major General Harry G. Woodbury
Chairman

Dear Mr. Chairman and Members of the
Harbor Advisory Board:

I have studied the latest report of the Corps of Engineers, transmitted by Col. Hodgson's letter of November 21.

I am pleased to express my support for the breakwater project, as revised, subject only to:

(1) the Town adopting a stringent set of controls on dumping and other forms of water pollution, both from local craft and visiting boats; and

(2) the Town developing contracts for the docks and shore facilities which contain tight provisions to protect the water quality.

In reducing the length of the proposed breakwater to 500 feet, as in Plan B, the Corps has adequately met the concerns I have repeatedly expressed on grounds of preserving water quality. The reduced length compensates sufficiently, in my judgment, for the failure to reorient the breakwater on the angle of North 42°E and South 42°W as called for in Plan C. As stated in the Report at page 15:

"Generally, the shorter the breakwater, the lesser its impact on flushing and water quality."

The Report demonstrates much greater care in its technical aspects than prior drafts, and it is more forthright in stating what the new breakwater will not accomplish. It poses the conflicting interests involved and strikes a sensible balance of the competing interests. In keeping the projected costs below $2,000,000, the revised plan vastly improves the chances of accomplishment of the project.

In addition to the major changes in the plan, an event of the utmost importance since the breakwater project was first proposed several years ago is the acquisition by the Town of the parcels of land around the harbor. For those who have been concerned about the possibility of uncontrolled commercial development resulting from the increased harbor protection, I suggest that considerable reassurance can be gained from the knowledge that the Town owns most of the harbor frontage.

We have come a long way since August 6, 1978, when a meeting was held in the Town Hall under the auspices of the Harbor Advisory Board to permit an airing of questions about the project. I said on that occasion that I was not taking a position until more facts were brought out and a water quality study could be accomplished. We have paid dearly in the passage of time for the failure of the original plan to address many matters forthrightly, including, in particular, the failure of the Corps to commission a water quality study at the outset. Now, that these omissions have been cured and the breakwater configuration has been significantly modified in a way that meets the findings of the water quality study, I urge that the Town and the Corps move with all possible speed. The goal should be one of commencing construction in September of 1981.

I am assuming that the Town will be able to achieve the necessary "backstop" commitments from the State to meet any costs over $2,000,000. Speaking personally, I will be glad to participate with others in any endeavor to seek the necessary appropriations at the Federal level. The sooner the project can begin, the more likely it is, quite obviously, to come in under the $2,000,000 figure.

This is a time for the closing of ranks and for positive steps forward.

Sincerely yours,

Roswell B. Perkins

Roswell B. Perkins

cc: Col. William E. Hodgson, Jr.
Mr. Steve Andon
Mrs. Jane P. Cabot

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Transportation
PLANNING DIVISION
State Office Building
Providence, R. I. 02903

December 5, 1980

Acting Division Engineer
U. S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254

Subject: NED PL-C
Project Report and Environmental Assessment
Sakonnet Harbor, Little Compton, Rhode Island.

Dear Sir:

Staff members have reviewed the report and environmental assessment for the proposed improvement of Sakonnet Harbor in Little Compton, Rhode Island. Our review comments follow:

1. Dredged Materials:

   An estimated 8,000 cubic yards of dredged materials are to be taken from the Harbor. The report states that this material will be disposed of at land sites provided by local interests. Disposal on land sites would appear to indicate that the material will be trucked from the harbor area via Sakonnet Point Road, Route 77.

   A major rehabilitation and resurfacing project has recently been completed on Sakonnet Point Road between the Point and Swamp Road. In some areas the roadway is only 24 feet wide with adjacent trees and dry rubble walls. The trucking of 8000 cubic yards of material will have to be in legal size loads and consideration to the time of hauling should be provided.

We also note that the section of Route 77 from Swamp Road north to East Road, Route 179 will shortly be under reconstruction. Reconstruction activities are anticipated through the Spring of 1982.

The dredged material by its nature will be wet and spillage can be anticipated during the hauling operations. The environmental assessment should address the steps that will be undertaken for cleanup, dust control, and air pollution from drying organic materials.

For highway projects we are required in environmental studies to address disposal areas for surplus materials. For 8000 cubic yards of dredged material this would seem even more appropriate considering that it could impact ground water in the area. Site restoration and the later secondary uses of the site with associated impacts should also be discussed.

2. Increased ADT

The report concludes that there will be an increase in ADT and vehicle emissions levels. However, the report does not present any figures. Estimates of increased ADT based upon an improved port facility, and an associate air quality analysis should be developed and addressed in the environmental assessment.

3. Noise

The report indicates that noise from the dredging operation could probably be treated if complaints arise. It would seem appropriate for the environmental assessment to be more definit. Existing noise levels should be determined and noise levels from dredging operations estimated. Any necessary restrictions on dredging operations and/or hours should be addressed.

The increase noise levels from the hauling of 8,000 cubic yards of dredged materials and an increased ADT should also be addressed.

4. Air Quality

In addition to air quality impacts associated with an increased ADT will their be any impacts from the dredging operations and later, the expanded use of the harbor area?

Sincerely,

Joseph F. Arruda
Chief of Planning

AJW/ea
cc: Mr. Flanders
Mr. Winiarski

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

DEC [illegible] 19[illegible]

Colonel William E. Hodgson, Jr.
Acting Division Engineer
Corps of Engineers, New England Division
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Hodgson:

These comments on the Draft Detailed Project Report and Environmental Impact Assessment concerning the feasibility of providing navigation improvements in Sakonnet Harbor, Rhode Island are submitted in response to your letter of November 21, 1980.

The System of Accounts, Table 4 following page 26, should include an assessment of the effects of the project upon benthic habitat and upon terrestrial wildlife that will be impacted at the recommended spoil disposal sites No. 1 and 2, shown on Figure 4-9. The expanded System of Accounts, Table 2-9 Appendix 2, does show the impact upon benthic habitat on page 2-14, but doesn't include the impact on terrestrial wildlife. Effluent and leaching from the disposal site will enter tidelands contrary to the statement on page 2-13 under Water Quality.

Predicted maintenance of the channel is discussed on pages 2-21 and 4-9. Even though a small amount of material is involved, a site for its disposal should be included in project plans and mentioned in the report.

Potential dredging of about 6,000 cubic yards from private piers is explained in paragraph 19, page 4-10. Disposal of this material in Site 3, an intertidal area south of the "Focsle" Restaurant (Figure 4-9), is being considered. This dredging and disposal will be subject to a Section 10 permit which we will report on when the Public Notice is received.

A copy of our April 30, 1979 report should be included in your final Detailed Project Report. The first paragraph refers to a previous report we provided on May 15, 1959. This date should be corrected to May 15, 1969.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor

ST. JOHN, PARK & SCOTT

ATTORNEYS AT LAW

19 WEST ELM STREET

MAIL ADDRESS P.O. BOX 697

GREENWICH, CONNECTICUT 06830

ORSON L. ST. JOHN

HALFORD W. PARK

GEORGE W. SCOTT, JR.

(203) 869-5330

December 9, 1980

Colonel William E. Hodgson, Jr.
Acting Division Engineer
U. S. Army, Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254

Re: Sakonnet Harbor Project

Dear Colonel Hodgson:

As one who maintains a summer home in Little Compton and a boat in Sakonnet Harbor, I hope it is not inappropriate for me to comment on the Draft Report transmitted with your letter dated November 21, 1980. I regret that I will not be able to attend the hearing on December 17.

I am pleased to express my support of the proposed breakwater (Plan B), but I have serious reservations with respect to the proposed channel widening from 80 to 110 feet (page 16). I believe this part of the project is based upon conclusions of doubtful validity and necessity.

The Harbor Master has advised that the proposed widening will require the relocation of 20 moorings of the total of 140. The Report states (par. 17, page 1 - 9) that the Harbor "is always filled to capacity and there are no new moorings and slips available" and this is consistent with what I have observed and been told and inconsistent with a conclusion that the relocations can be accomplished by increased use of the northern part of the Harbor in the lee of the proposed breakwater or by better management of existing moorings (2nd par., page 16 and pars. 62 and 63, page 2-22). I believe the Report concedes that no moorings can be located north of the present moorings because of the southwest exposure and the refracting/diffracting effect of the new breakwater.

As to the necessity for the widening the Report states (par. 35, page 5-15) that "two-way traffic capability would be a necessity because construction of a breakwater would force many recreational vessels to utilize the channel to enter and exit the Harbor", but concedes "economic benefits would accrue even in

one-way traffic because the time required for channel passage is minimal..." I fail to see how the construction of a breakwater will change the pattern of getting to and from moorings, except at the entrance between the two breakwaters where the width scales to 220 feet ± with ample turning area. If anything, the channel widening will require a further concentration of moorings and increase the difficulties of getting to and from them and the chances of damage when storms occur.

In view of the foregoing it would seem that the channel widening could be eliminated without serious consequences and that this should be done. To do so would not only avoid the adverse effects of a further concentration of the present moorings but have the added advantages of reducing the quantities of dredging and overall cost of the project with a diminished risk that the ultimate cost will exceed $2,000,000.00.

Referring to the conditions of the draft recommendation (page 47) I would hope that the commitments of the "local interests" will be in contract form and subject to public comment before the Corps proceeds.

Respectfully,

Orson L. St. John

OLSJ:JV

cc: Mag. Gen. Harry G. Woodbury
Harbor Advisory Board
Little Compton, Rhode Island

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Administration
STATEWIDE PLANNING PROGRAM
265 Melrose Street
Providence, Rhode Island 02907

December 1[illegible] 1980

Col. William E. Hodgson, Jr.
Acting Division Engineer
U.S. Army, Corps of Engineers
New England Division
424 Trapelo Road
Waltham, MA 02254

Dear Col. Hodgson:

This office, in the capacity of clearinghouse designate, under OMB Circular #A-95, Part II, has reviewed the Draft Detailed Project Report and Environmental Assessment for the small navigation project in Sakonnet Harbor, Little Compton, R.I.

The results of this review and the staff recommendation was presented to the Technical Committee of the Statewide Planning Program at its meeting December 5, 1980. The Technical Committee has adopted a position of no comment. The Army Corps of Engineers is encouraged to seriously consider any forthcoming comments from the R.I. Coastal Resources Management Council and any other interested parties.

Thank you for the opportunity to review this project.

Yours very truly,

Rene' J. Fontaine
A-95 Clearinghouse
Coordinator

RJF/sjc

Reference File: EIS-80-08

NEDPL-I 12 December 1980

Mr. John Lyons, Chairman
Coastal Resources Management Council
60 Davis Street
Providence, Rhode Island 02908

Dear Mr. Lyons:

This is to inform you that the proposed dredging and breakwater construction project at Sakonnet Harbor, Little Compton Rhode Island, has been evaluated for the purpose of making a consistency determination in accordance with your approved "State of Rhode Island Coastal Management Program and Final Environmental Impact Statement."

Inclosed is a copy of the Detailed Project Report prepared by us which describes the activities involved in the project. The document was reviewed for consistency with the Rhode Island Coastal Zone Management Program (list of policy numbers is attached). We find that, as proposed, the project is consistent with the cited policies.

I would appreciate your expeditious review on our determination that the proposed work is consistent with your Coastal Management Program.

Should you have any questions, please feel free to contact me at (617) 894-2400, extension 220. Mr. Andon of my staff coordinated the investigation. Should your staff desire additional information, he can be reached at extension 554.

Sincerely,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

3 Incls
As Stated

<u>POLICY NUMBERS</u>

110.0 - 2	Tidal Waters and Coastal Ponds
120.0 - 2	Shoreline Systems
130.0 - 2	Flood Hazards
140.0 - 2	Coastal Erosion
210.0 - 2	Marine Fish and Fisheries
220.0 - 2	Aquaculture
230.0 - 2	Mineral Extraction
250.3 - 2	Freshwater Wetlands
310.0 - 2	Coastal Water Quality
320.0 - 2	Ocean Dumping
410.0 - 2	Public Access to Shore
420.0 - 2	Public Beaches and Parks
430.0 - 2	Conservation and Management Areas
450.0 - 2	Historic Preservation
460.0 - 2	Research
470.0 - 2	The Bay Islands Park
510.0 - 2	Residential Development
550.0 - 2	Transportation and Transportation Facilities
700.0 - 2	Public and Government Participation

C.5 Consistent Federal Actions

5.1 Federal Activities and Development Projects:

(1) Federal agencies shall provide the Council routine and timely notification of all proposed activities and development projects located or proposed to be located in the Rhode Island coastal region (defined as the state's 21 coastal municipalities).

(2) They shall further provide the Council such notification of all proposed direct federal activities and development projects likely to directly affect (as defined in 930.32 Federal Register, Vol. 42, No. 167) but not actually located in the state's coastal region. Such activities and projects include, but are not limited to planning, construction or modification of major facilities or installations within the state of Rhode Island but not within the coastal region.

(3) The Council shall construe "timely notification" as follows:

a. Notification must be in writing and submitted at the earliest practicable time, at a minimum, 90 days prior to the stage at which alternatives to the proposed action may no longer reasonably be considered.
b. Notification should be submitted directly to the Council.
c. Notification must indicate the involved agency's assessment of its consistency or lack thereof with applicable provisions of the Rhode Island Coastal Resources Management Program. Such assessment must address effects and consistency with specific Council Management Regulations and Policies.
d. Notification shall describe the proposed action or project in sufficient detail, including as appropriate facility development plans, maps, engineering drawings, or other data and information, that the Council may independently evaluate its consistency with specific Management Regulations and Policies and the various permissibility standards and criteria contained therein.

(4) The Council shall notify in writing federal agencies proposing activities and development projects, under this section, of its agreement or disagreement with their consistency determination within 45 days of receiving said determination and supporting documentation as described under (3), c and d, above; provided that the Council may where necessary request an additional 30 days to evaluate and respond to federal agency determinations pursuant to 930.42(b) of proposed NOAA regulations.

(5) Where the Council disagrees with an agency determination of consistency it shall indicate the nature of its objection with specific reference to applicable Management Regulations and Policies as contained in the Coastal Resources Management Program. It shall further recommend alternatives to or modifications of the proposed action that would render it consistent with said applicable provisions. A copy of such notification shall be forwarded to the Associate Administrator for Coastal Zone Management.

D GOODRICH
123 EAST 94 ST
NEW YORK NY 10028

western union Mailgram

4-027270S351 12/16/80 ICS IPMMTZZ CSP BSNB
2127228357 MGM TDMT NEW YORK NY 47 12-16 0123P EST

COLONEL WILLIAM E HODGSON JR
CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM MA 02254

I JOIN OTHERS IN SUPPORTING THE SAKONNET HARBOR IMPROVEMENT PROJECT, AND ALSO IN URGING THE ADOPTION OF STRINGENT WATER POLLUTION CONTROLS AND THE DROPPING OF THE PROPOSAL TO WIDEN THE CHANNEL.
DAVID GOODRICH

13:24 EST

MGMCOMP MGM

19 DEC 1980

STATEMENT ON PROPOSED SAKONNET HARBOR PROJECT

The past three years have produced much needed clarification and improvement in the project.

Financial risks. The Town Council originally intended that the Town assume the financial risks, specifically, that it "hold and save the United States free from damages" and "assume full responsibility for all project costs over the Federal limitation of $2,000,000." Even after a June '79 hearing that showed strong sentiment against such risk-taking, the Council President rejected a suggestion to seek State aid, on grounds that the State might attach burdensome conditions. Finally, in December '79, the Council asked the State to assume those risks.

Cost estimates. Proponents have consistently underestimated the impact of inflation. The current construction cost estimate of $1,800,000 (based on June '80 prices) has managed to remain below the Federal ceiling only by drastic reductions in size of channel, length of breakwater, and weight of armor stone. While the New England Division has an admirable record of controlling costs in small navigation projects, Col. Chandler, former Division Engineer, and Steven Andon, the project manager, both have admitted that unprecedented inflation, especially in fuel costs, makes the past little guide to the future. Nor must the 12% contingency in this estimate be considered an inflation cushion, as many have done; back in the days of minimal inflation, I understand, the same percentage contingency would have appeared at this stage. Contingencies are meant to cover changes in project specifications, not changes in unit costs. Until Mr Andon informed me last April, no one in Town realized that Corps estimates excluded pre-construction administrative costs, which count toward the Federal limit. Last April Mr Andon's estimate was $180,000; actual costs through November '80 are due for release tonight. Should pre-construction costs remain at last April's estimate, the current total estimate is already just $20,000 shy of the Federal limit. And that's at last June's prices and without costly changes in specifications during construction. Construction can begin no sooner than Labor Day of '81; slated to take a year, its midpoint would fall around March of '82, 21 months after the current cost-basis date. If inflation remains at its current rate, the probable cost would run hundreds of thousands of dollars over the Federal limit.

<u>Breakwater length</u>. Three years ago the Council requested a 650-foot breakwater, which would have seriously hindered flushing of the harbor. Financial and environmental concerns have shortened it to 500 feet, which would permit adequate flushing and still protect the harbor against northerly storms, but not against ice. Ice-protection was one of the principal arguments for a new breakwater.

<u>Local agreements</u>. The first draft agreement between the Town and Sakonnet Rogers, published last February, was faulted on several counts and withdrawn. Since then it has been thoroughly renegotiated. Adequate pollution controls have been added, while the all-purpose 50-year tax-exemption has been totally eliminated; all marine facilities will be fully taxed. An agreement with Mr. Mataronas remains in negotiation.

<u>Mooring space</u>. Right now the harbor has 12 acres of prime mooring space (that is, anchorage protected against SW storms and not used as channel), containing about 125 of the harbor's 140 moorings. From the start and until very recently, proponents have been claiming that the project would increase mooring space. The Sakonnet Yacht Club voted to stay neutral, because most members believed--and <u>still</u> believe--that the project would add mooring space, or at least not reduce it. Early this summer Gen. Woodbury argued that by increasing anchorage, this project would attract more summer residents, who would build more houses, which would increase the tax base and lower the tax rate. However this Report reveals that channel enlargement would eliminate 1/2 acre--or 4%--of prime mooring space, while the new breakwater would create no new mooring space, prime or otherwise. Just a week ago the Harbor Master, Mr. Blades, estimated that channel enlargement would eliminate 20 moorings. Gen. Woodbury has told me that the new docks would eliminate another 3 moorings, for a total loss of 23 prime moorings (or 18%).

What will become of the displaced boats? Mr Blades has suggested that some could be rafted and some could move into Mr. Rogers' slips (at a fat increase in fee), while the Report suggests that some could be sent into the less-than-choice northerly anchorage already in use, which would become even less protected than it is now against the summer's prevailing SW storms, whose waves would be heightened 20% by reflections off the new breakwater. The last Harbor Board meeting suggested that the cost of moving these moorings would be borne solely by the displaced boat owners--which is telling men to pay their own way to Siberia.

This hearing, scheduled for a weeknight one week before Christmas, couldn't come at a time less likely to gain the attention and attendance of recreational boaters and other summer residents, who are scattered to the winds and distracted by the normal holiday panic. Let me say that summer residents, willingly or not, support every other taxpayer in Town by paying taxes at the full rate while sending their children to out-of-town schools and using Town roads and services just a fraction of the year. It's no coincidence that Little Compton, with the State's second-highest ratio of summer residents to year-round residents, enjoys the second-lowest tax-rate; or that Block Island, with the highest ratio, enjoys the lowest rate.

Neither group of harbor users should profit at the other's expense. And no one should suffer expropriation without notification and adequate time to protest. Fishermen and recreational boaters should receive--and a majority should approve--detailed plans and costs of any new mooring arrangements before this project is submitted to the voters.

I will happily support the project, providing

1) the Mataronas agreement is as strict as the Rogers;

2) the State imposes no burdensome conditions in return for its help;

3) new mooring arrangements and costs are known to all fishermen and recreational boaters, and approved by a majority; and

4) the Town neither holds the United States free from damages, nor assumes any responsibility for project costs.

In closing, I'd like to commend Steve Andon for his candor, good humor, and professional skill.

Karl Haffenreffer

Karl Haffenreffer

Sakonnet Point Farm
17 December 1980

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
OFFICE OF THE DIRECTOR
83 Park Street
Providence, R. I. 02903

December 19, 1980

Colonel William E. Hodgson, Jr.
Acting Division Engineer
New England Division
Corps of Engineers
424 Trapello Road
Waltham, Ma. 02254

Dear Colonel Hodgson:

Be advised that the Department of Environmental Management has reviewed the Sakonnet Harbor, Little Compton, Rhode Island, Draft Detailed Project Report, dated November, 1980. Technical comments and recommendations concerning the modifications of a 500 foot long, rubblemound breakwater and a 110 foot wide major access channel at a depth of ten feet, proposed in the project report, as included in "Plan B" and as shown on Plate III, will be furnished to you by separate letter. I address in this letter my position as Director concerning the items of local cooperation delineated in the report.

The Director of the Department of Environmental Management, acting on behalf of the State of Rhode Island pursuant to the authority of Title 46, Chapter 2 of the General Laws, and with the approval of the Governor, expects to be both prepared and able to meet the following specific items of local cooperation as delineated on page 18 of the above referenced report:

- hold the United States free from damages that may result from the construction and maintenance of the project;

- assume the responsibility for all project costs in excess of $2,000,000.

This statement of expectation is made upon the understanding of the Director that the project will be of direct and substantial economic benefit to the Town of Little Compton and the State of Rhode Island, including significant benefits for the Rhode Island fishing industry. Further,

it is made based on cost estimates provided in the project report and discussed earlier with Department counsel which indicate that the expected cost of the project at this time is somewhat less than $2 million. The State explicitly reserves the right to review cost estimates after the completion of detailed plans and specifications and before entering into any formal agreement.

It is, therefore, requested that your office proceed with preparation of the detailed plans and specifications for the project. It is my understanding that you will propose formal agreements relating to the specific items of local interest noted above at some time in the future.

Kindly keep us advised of your progress.

Very truly yours,

W. Edward Wood
Director

WEW:db
cc: Governor Garrahy
Jane P. Cabot
Senator Canulla
Gen. Woodbury
John Lyons

Town of Little Compton
Rhode Island

December 22, 1980

Colonel William E. Hodgson Jr.
Acting Division Engineer
New England Division, Corps of Engineers
424 Trapello Road
Waltham, Massachusetts 02254

Dear Colonel Hodgson,

The Town of Little Compton has reviewed the "Sakonnet Harbor, Little Compton. Rhode Island Draft Detailed Project Report", dated November 1980. We agree with the report recommendation for project modifications of a 500-foot long rubble-mound breakwater and a 110-foot wide major access channel at a depth of ten feet both as inclued in "Plan B" and as shown on Plate III in the draft report. Our detailed comments on the report are attached as enclosure 1. Many of these have been made before. We would appreciate an opportunity to discuss with you, prior to initiation of design, the basis for rejection of any comments.

This community expects to be both prepared and able, jointly with the State of Rhode Island, to meet the iems of local cooperation as outlined in the report as Non-Federal Responsibilities. This commitment is made under the provisions of Title 46 Chapter 2 general laws of Rhode Island.

We request that your office proceed expeditiously with preparation of the detailed plans and specifications. Please keep us advised of your progress. We plan to present the project to the voters by resolution at our annual Town Meeting 7 April 1981 and obtain their endorsement of the project. Following that meeting we expect to be prepared formally to sign the assurances as required.

In view of our earlier commitment to the public that they would have 30 days after notice of availability of your report in which to comment, we have announced that the record for comments would be open until December 27, 1980. We request therefore, that your grant an extension until January 12, 1981, for any supplimental comments that the Council might elect at its next meeting January 8, 1981 to submit.

Thank you for your consideration.

Sincerely,

Jane P. Cabot

President, Town Council

Enclosure a/s
w/4 attachments

Best Available Copy

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
83 Park Street
Providence, R. I. 02903

February 6, 1980

Honorable Dennis J. Roberts, II
Attorney General
Providence County Courthouse
250 Benefit Street
Providence, RI 02903

Dear General Roberts:

The Town of Little Compton has arranged with the Corps of Engineers of the United States Army for the construction of a breakwater at the northerly entrance to Sakonnet Harbor. The Corps has reviewed the project, and has recommended that construction of it proceed under Section 107 of the Rivers and Harbors Act of 1960 (33 U.S.C.A. § 577). That section allows the federal government to embark on small river and harbor improvement projects not specifically authorized by Congress, and to pay the entire cost of such projects where the cost is less than the statutory maximum of federal participation in a single project. That maximum is now $2,000,000.00.

Subsection (c) of Section 107 provides certain requirements that the "local interests" (state, county, municipality or other local entity) must fulfill in order for a project to proceed. The Town of Little Compton has requested that responsibility for two of these requirements (the attached correspondence gives details as to the entire subsection) be borne by the State. In particular, the Town has asked that the State: hold and save the United States free from damages that may result from the construction and maintenance of the project; and to assume responsibility for the non-federal share of the project cost. In this case, the non-federal share would be any cost in excess of $2,000,000.00. Since the current (October, 1979) cost estimate, including a fifteen percent contingency allowance, is $1,489,000.00, the assumption of this burden is a contingency which may be remote (the average over-run in New England for such projects is negative 21 percent).

There is now statutory authority for either the State or a munici-
[illegible] harmless clause [illegible]

Sec 42-2-3, 46-2-21) In addition, [illegible] -2 provides that the

3-76 Inclosure to 22 December 1980 letter from Little Compton Town Council

Attachment 1

Director of Environmental Management "is authorized to negotiate, cooperate and enter into agreements in behalf of this state with the United States of America in order to satisfy the conditions imposed by the United States of America authorizing any project for the improvement of navigation of any harbor or river and for the protection of property against damage by floods or by erosion, provided such project shall first have been approved by the governor." I am not certain, however, whether this latter section is a broad enough grant of authority to encompass the required commitment to assume the contingent responsibility for any costs in excess of the maximum federal share. I therefore am writing to request your opinion as to the reach of Section 46-2-2, specifically, whether it is sufficient authority to allow the Director of Environmental Management, with the Governor's approval, to assume the contingent expense responsibility for the State.

The attached correspondence details past instances when the State or municipalities have executed similar commitments; it is not clear under what authority those commitments were given.

If you have any further questions, please feel free to contact me.

Very truly yours,

R. Daniel Prentiss
Chief Legal Counsel

/kl

STATE OF RHODE ISLAND & PROVIDENCE PLANTATIONS
DEPARTMENT OF THE ATTORNEY GENERAL
PROVIDENCE COUNTY COURT HOUSE
PROVIDENCE

DENNIS J. ROBERTS II
ATTORNEY GENERAL

March 27, 1980

R. Daniel Prentiss, Esq.
Chief Legal Counsel
Department of Environmental Management
83 Park Street
Providence, Rhode Island 02903

Dear Mr. Prentiss:

You have requested an opinion as to whether Section 46-2-2 of the Rhode Island General Laws authorizes the Director of the Department of Environmental Management (hereinafter Director) to commit the State to pay costs in excess of the two million dollar ($2,000,000) commitment to a project by the Army Corp of Engineers. Under federal law the Army Corps of Engineers is prohibited from allotting more than two million dollars ($2,000,000) to the breakwater project, 33 U.S.C.A. 577 (b), and local interests may be required to hold and save the U.S. free from future damages that my result from the construction and maintainence of the project. 33 U.S.C.A. 577 (c).

Title 46, Chapter 2 of the General Laws authorizes the Director, with the approval of the Governor, to hold and save the United States harmless from claims or damages resulting from harbor improvement or protection projects, R.I. General Laws §46-2-3, and to "enter into agreements in behalf of this State with the United States of America authorizing any project for the improvement of navigation of any harbor or river . . . " R.I. General Laws §46-2-2. See also R.I. General Laws §42-17.1-2 (d). Title 46, Chapter 2 thus grants the Director broad authority to enter on behalf of the State into agreements with the United States for the improvement of navigation in harbors and rivers. Title 46, Chapter 2 gives the Director broad authority to apply for federal aid for harbor improvement projects. See R.I. General Laws §46-2-1, §46-2-2, §46-2-3.

Payment of State contributions by the Director is addressed by Section 5 of Title 46, Chapter 2. Section 5 specifically [illegible] the Director to provide for payment by the State where an appropriation has been made by the General Assembly and a cash contribution is required by the United States.

> Payment of state contributions. - Where an appropriation has been made by the general assembly for such purpose, the director of natural resources, with the approval of the governor, is authorized to provide for the payment by the state of the cash contribution required by the United States of America for any such improvement or protection project. R.I. General Laws 46-2-5.

It is clear that the Director does not propose to enter into a contract requiring the State to pay any part of the cost of the project. Since the Army Corps of Engineers is bound by statute to limit its expenditures for the project to the sum of $2,000,000, and there appears to be no basis for concluding that the cost of the project will exceed that sum, the Director is not entering into a contract which, at the time of its execution, exceeds the sum available for its implementation. A State agency may enter into a contract which, for unforeseen reasons, may result in State liability exceeding the contract price and the appropriation provided therefor. Such a contingency does not constitute an agreement on the part of the Director for the expenditure of funds for which no appropriation has been made.

Section 46-2-5 set forth supra, relates to a contract entered into by the Director providing a cash contribution by the State required by the Federal Government for an improvement or protection project. The United States has no such requirement for the instant project. The purpose of the hold-harmless provision and the assumption of responsibility by the State for any contingent overrun in costs is to satisfy the Federal limitation of liability for any project to the sum of $2,000,000. There is no expectation that the amount expended will exceed the amount provided by the Federal Government for the project.

The question presented is whether the Director is creating a present indebtedness on the part of the State in pledging the State's credit to assumption of responsibility for possible cost overruns, so as to violate the constitutional prohibition against incurring a State debt exceeding $50,000 without the consent of the people. Article XXXI of the Rhode Island Constitution.

It should be noted that the statutory authority of the Director to hold the United States harmless from claims resulting from such improvement, may possibly result in State liability exceeding the contract price. In Opinion to the Governor, 308 A 2d 802 (R.I. 1973), the Court was examining a proposed lease with the State for a term of years and quoted with approval from Los Angeles v. Offner, 19 Cal. 2d 483, 122 P 2d 14, 16 (1942); " . . . if the lease or other agreement is entered into in good faith and creates no immediate indebtedness . . . no violation is done to the constitutional provision . . . " In the instant matter, the Director is entering into an agreement in good faith for the expenditure of a sum provided by a Federal grant, and is not creating an immediate obligation for the payment of moneys in excess of the amount made available by the Federal grant.

Therefore, it is the opinion of this office that the Director of Environmental Management may, on behalf of the State, enter into an agreement with the Corps of Engineers of the United States Army for the construction of a breakwater at the northerly entrance to Sakonnet Harbor, for a sum not to exceed the sum of $2,000,000 to be provided by the United States, and that such agreement may include a provision to hold the United States harmless from claims and damages resulting from such project and for the State to assume responsibility for any project cost in excess of $2,000,000.

Very truly yours,

Dennis J. Roberts II

DENNIS J. ROBERTS II
Attorney General

DJR:gaj

Statement of the President of the Town Council, Little Compton, Rhode Island, presented at the Public Hearing of the Army Corps of Engineers, June 17, 1979, concerning proposals for improving Sakonnet Harbor.

I am Jane Cabot, President of the Town Council.

On behalf of the Little Compton Town Council I would like to present the following statement concerning the proposed improvements at Sakonnet Harbor. This statement was considered at our regular meeting held June 21, 1979, and was endorsed by a unanimous vote.

First we wish to express our appreciation to the Army Corps of Engineers for their efforts in preparing the feasibility report. Their study and report has been in response to the Town's request of 1975 and to resolutions of the Senate and House of Representatives Public Works Committee dated May 11th and September 26th, 1976. The Town Council is very appreciative to Senator John O. Pastore, Senator Clairborne Pell, and Representative Fernand J. St Germain for their help and support in the passage of the above mentioned resolutions. We would also like to thank Mr. John Lyons, Chairman of the Rhode Island Coastal Resources Management Council, for his cooperation and encouragement in the study.

For more than 300 years Little Compton has been a beautiful rural area. For most of these 300 years the economy of Little Compton has been based on farming and fishing. During the present century a significant part of Little Comptons' economy has also been the result of our large summer colony -- people who choose Little Compton over other communities because of its rural

characteristics. The Town Council feels that the proposed improvements to Sakonnet Harbor and the resulting economic benefits to one of rural Little Compton's major industries will help to preserve these rural characteristics.

An improved harbor will enhance our commercial fishing industry. Without the planned improvements with its northerly breakwater and improved channel (both of which would allow a twelve month fishing season) our fishermen tell us they would be unable to support the investments necessary for modernization. Without adoption of modern methods with modern equipment our fishing industry can be expected to deteriorate and our employment opportunities will be reduced.

An improved harbor will not only prevent the loss of jobs in Little Compton, it will create new employment opportunities. The Rhode Island State Office of Employment Security reports that the average number of Little Compton residents employed in 1978 to be 827. A recent census of fishermen operating out of Sakonnet Harbor and the directly related shore activities to be 155 people of which 81 were Little Compton residents. Thus about 10% of Little Compton's work force is employed at least part time working out of Sakonnet Harbor. This same census indicated that if the harbor is improved the number of people employed in fishing would increase about 30% between now and 1985 and the total man days of employment would increase more than 40%. The difference in the projected increases is due to the longer fishing season permitted by the breakwater. This is particularly important to Little Compton where our unemployment rate in the wintertime varies from 8% to 14% versus an unemployment rate of from 5% to 8% in the summertime.

A safer harbor more readily adaptable to accommodating additional recreational water craft of Town property owners also enhances our fundamental goal of preserving the balance among the several elements of our population. The proposed improvements have been engineered so as not to preclude later expansion of facilities for recreational craft should that be found to be desirable at some future date. This would indirectly contribute further economic benefits to the Town.

We must not forget a very important benefit that an improved harbor with a northerly breakwater will provide. Many times I have heard the words "harbor of refuge" mentioned. One can not put a price on human life.

We are convinced that the economic benefits associated with the Corps plan are substantial. We are assured by the Corps Environmental Studies that the costs in terms of environmental degradation will be insignificant. The maintenance of water quality in Little Compton's waters is of vital interest to the Town. We understand from the feasibility report of the Corps that the breakwater and dredging will cause directly no significant long term reduction in the quality of water in the harbor by physically changing adversely any flow or currents in the harbor. We understand, of course, that the improvement of the harbor could indirectly affect water quality to the extent that the improvement increases the boat/day use of the harbor. There will be a concomitant increase in the threat of pollution from these boats whether they be commercial or recreational. Just as the laws were changed and enforced to prevent residents from dumping raw domestic sewage into the harbor, so the laws and

rules and regulations with respect to waste discharges from boats are being changed. The enforcement of these new laws will be the responsibility of the Coast Guard, the State, and the Town and we fully expect these responsibilities to be carried out. The Rhode Island General Assembly recently passed an Enabling Act that gave the Town authority, by Town Ordinance, to prevent both water and land pollution in the harbor and provides for a $100.00 fine for each offense plus the costs associated with the liability for clean up.

The Town Council understands the requirements for local assurances, and we fully expect that the Town will provide these assurances within the limitations of State Statutes. Although the assurances include no specific requirement for a Town financial contribution, all engineering and construction costs being federal, the Town Council intends to give the Town's people an opportunity to vote on a resolution endorsing this important development in the Town. We expect this to be done at a Town Meeting after the Corps has completed its detailed engineering studies and made its detailed cost estimates and before any construction contract has been awarded. We urge the Corps to proceed expeditiously to reach this point. The technical comments to be made by the Harbor Advisory Board will expand on this point.

The Town Council wishes to take this opportunity to thank the Harbor Advisory Board for their many hours of work relating to this Harbor improvement project. As you probably all know, the Board consists of nine members appointed by the Town Council under guidelines set forth in Little Compton's Harbor Master

Ordinance. This present study concerning Sakonnet Harbor actually started back in 1973 when Pat Parente, a Town Council member and the Council's representative to the Advisory Board, as a result of his talks with local fishermen, became aware of the need for further improvements at Sakonnet Harbor. The Town Council, by resolution, then asked the Harbor Advisory Board to study the need for a "northerly breakwater and additional dockage for commercial fishermen."

A special thanks to Harry Woodbury who was appointed to the Advisory Board in February, 1976. The Town Council realizes that he has devoted many hours to this project. His time and his effort have been greatly appreciated.

Thank you for the opportunity to make this statement on behalf of the Town Council.

Enclosure to letter from Town of Little Compton to the Division Engineer dated 22 December 1980.

The following comments on the "Draft Detailed Project Report and Environmental Assessment, Navigation Project, Sakonnet Harbor, Little Compton, Rhode Island" dated November 1980 are submitted for your consideration:

1. Plate II: The Harbor Advisory Board expects to submit further recommendations pertaining to channel alignment, width and depth. Comment 3 pertaining to 1.03 Pg. 1 in memorandum to the Division Engineer dated May 21, 1979; technical comments on layout, page 3 dated June 27, 1979 submitted in writing at your public hearing in Little Compton. (This comment pertains equally to Plates III, Figures 2-2, 2-3, 2-4, 2-5, 2-6, 4-2, 4-3, 4-5. 4-9, 4-10, 4-14) Incidentally the channel alignment proposed in your report passes over the rock off-shore of lot 79 which we understood was to be removed to current project depth as a maintenance item.

2. Page 11, 20, 28, 30, 2-8, 2-23: In the basic report plan B describes the breakwater as starting 450 feet off shore. In appendix 2 the distance from shore is described as 300 feet.

3. Page 16, paragraph 4: (Reffering to Social Impacts) Add to the end of the paragraph "occuring principally in the winter time".

4. Pages 18, 2-25, Non-Federal (Local) Responsibilities: The Town of Little Compton expects to co-sponser the project with the State of Rhode Island. Please revise all language in the report to reflect this joint sponsorship. See comment 19 enclosed with letter to the Division Engineer dated 15 March 1980, and enclosures thereto. See also attachments 1-2 hereto: Memo from DEM, Rhode Island, to Attorney General Feb. 6, 1980 and the reply from the Attorney General dated March 27, 1980. See also the State's most recent reply to your request for comments on this report.

5. Page 21, "Economic Impacts": Suggest adding "This plan will not interfere with the H. W. Wilcox fish trap north of the harbor entrance".

6. Page 32, paragraph 5: Change 360 miles to 0.56 square miles.

7. Page 41, paragraph 1: Suggest deleting the paragraph as written and substituting the following: "The traffic relating to the transportation of fishery products is viewed as an insignificant addition. The total landings are projected to be less than those reported for the late 60's and early 70's—the increase will occur principally in the winter time after the traffic congestion associated with summer visitors is substantially reduced. The improvement of the marina could result in the addition of 10 or 12 additional slips. Those would generate an incremental increase in traffic in the summer time but the increment can be expected not to exceed 10 percent".

8. Page 41, para 4: Should not all references be to "MLW"?

9. Page 42, Para 1: See comment 8.

10. Page 1-6, Para 11: "Seaconnet" was incorporated into the Plymouth Colony in 1682 and into Newport County, State of Rhode Island as Little Compton 1746/7. See comment 1 to letter Harbor Advisory Board to the Division Engineer, 2 Janury 1980.

11. Page 2-16, Regional Development, item 5: Should read "yes--yes--yes"

12. Page 2-22, para 4, line 5: Change to read "***and in fact increase, the wave heights***"

13. Attachment 3 is a copy of the Statement by the President of the Town Council submitted and read at your public hearing in June 1979., Suggest you consider including it in your appendix 3 after page 3-25. It bears on the economic development aspects of the project.

14. Page 4-7, Para 12, line 6: "Rock will be removed by bucket dredge and disposed of in deep water in the harbor." We would greatly prefer to retain what little deep water exists in the harbor. In addition it would appear that more efficient use of the rock could be made by using it in the disposal area retaining dikes.

15. Page 4-10, Para 18, et seq: See comments 14, 23, and 30 and enclosures 3 and 4 to letter to the Division Engineer from the Harbor Advisory Board, March 15, 1980 and comment 28 enclosure 1 letter to the Division Engineer from the Harbor Advisory Board dated 2 January 1980. See also attachment 4 hereto.

   a. Lot 75 has also been designated for dredge spoil as a part of area 2

   b. Disposal site 1 appears to be about one acre, not 0.25 acres and disposal site 2 more like 0.6 acres rather than 0.16 acres. Reference your "Survey Record" sheets 1 and 2 October 1979.

   c. The existing ground levels vary from 0.0 MWL to 17.0 MWL. Thus the statement that the spoil areas will reach elevations "12 and 10.25 feet above existing ground level at disposal sites 1 and 2 respectively" could be inferred to mean that the spoil areas could reach elevations 29' MWL site 1 and 20 feet at site 2. This of course is objectionable. It is our understanding that the Federal and private dredging will be contained below elevations 17, 9 and 11 feet respectively at sites 1, 2 and 3 respectively. If our understanding is incorrect please advise us as soon as possible so provisions can be made to include in your report additional areas for disposal.

16. Figure 4-9: The easterly boundary of site 3 does not conform to the most recent harbor development plan provided to your office. See attachment 4 hereto.

17. Page 4-13, 8 lines from the bottom: Should not the text read "2.25 feet=1.0 p.s.i.?"

Attachments 4 a/s

Best Available Copy

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF PLANNING AND DEVELOPMENT
83 Park Street
Providence, R. I. 02903

December 22, 1980

William E. Hodgson, Jr.
Colonel, Army Corps of Engineers
Acting Division Chief
N.E. Division
4242 Trapelo Road
Waltham, MA 02254

Dear Colonel Hodgson:

RE: NEDPL-C

The Department of Environmental Management has reviewed the detailed project report and environmental assessment for the small navigation project, Sakonnet Harbor, Little Compton, RI. We find the assessment to be well written and giving a fairly good assessment of the potential impacts related to the Breakwater project.

The only area where we find lack of an adequate assessment is that relating to the potential impact to recreational boating. The assessment should give a precise analysis of the amount of moorings that will be eliminated and areas which now can be used to moor recreational boats.

The assessment should also outline the impacts of alternate width channels to see if dredging a smaller channel will still maintain the adequate safety and perhaps increase the area available for recreational boating.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

Victor A Bell

Victor Bell
Sr. Planner

VB:lmh

cc W. E. Wood
3-00

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Environmental & Technical Services Division
Environmental Assessment Branch
7 Pleasant Street
Gloucester, Massachusetts 01930

DEC 23 1980

Col. William E. Hodgson, Jr.
Acting Division Engineer
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Hodgson:

This is in reference to your letter of November 21, 1980, requesting our comments on the Draft Detailed Project Report and Environmental Assessment concerning navigational improvement in Sakonnet Harbor, Rhode Island.

Due to manpower and time limitations we are unable to adequately respond to your request at this time. However, until such time as we are able to respond directly to you on the above project, we concur with the U.S. Fish and Wildlife Service letter (copy enclosed) to you dated December 9, 1980.

Sincerely,

Ruth Rehfus

Ruth Rehfus
Acting Branch Chief

Attachment

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

DEC 9 1980

Colonel William E. Hodgson, Jr.
Acting Division Engineer
Corps of Engineers, New England Division
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Hodgson:

These comments on the Draft Detailed Project Report and Environmental Impact Assessment concerning the feasibility of providing navigation improvements in Sakonnet Harbor, Rhode Island are submitted in response to your letter of November 21, 1980.

The System of Accounts, Table 4 following page 26, should include an assessment of the effects of the project upon benthic habitat and upon terrestrial wildlife that will be impacted at the recommended spoil disposal sites No. 1 and 2, shown on Figure 4-9. The expanded System of Accounts, Table 2-9 Appendix 2, does show the impact upon benthic habitat on page 2-14, but doesn't include the impact on terrestrial wildlife. Effluent and leaching from the disposal site will enter tidelands contrary to the statement on page 2-13 under Water Quality.

Predicted maintenance of the channel is discussed on pages 2-21 and 4-9. Even though a small amount of material is involved, a site for its disposal should be included in project plans and mentioned in the report.

Potential dredging of about 6,000 cubic yards from private piers is explained in paragraph 19, page 4-10. Disposal of this material in Site 3, an intertidal area south of the "Focsle" Restaurant (Figure 4-9), is being considered. This dredging and disposal will be subject to a Section 10 permit which we will report on when the Public Notice is received.

A copy of our April 30, 1979 report should be included in your final Detailed Project Report. The first paragraph refers to a previous report we provided on May 15, 1959. This date should be corrected to May 15, 1969.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor

PLANNING BOARD
TOWN OF LITTLE COMPTON
RHODE ISLAND
02837

January 6, 1981

Mrs. Jane Cabot, President
Town Council
Little Compton

Dear Mrs. Cabot:

The Planning Board met on January 5, 1981, with the following members present: Virginia Withington, Virginia Lynch, Russell Racotte, David Emilita, and Manuel Ronasco. Also present was William Sutton, from the R.I. Department of Community Affairs. The following position was adopted unanimously, with subsequent endorsement by Chairman Robert Buben.

The Little Compton Planning Board after study of the proposed plan for the Sakonnet Harbor breakwater and channel has concluded that the Town would not benefit to the extent stated in the Army Corps of Engineers' report, and that the financial liabilities could be of frightening dimensions to the Town taxpayers.

1. The new construction would be of benefit to offshore fishermen with large boats at the expense of the small local commercial fishermen. Commercial landowners at the harbor's edge will profit, while the increased activity may reduce the amenities for the residents of the neighborhood.

2. The Town is being asked to guarantee its participation in the Project before the Army Corps of Engineers has obtained the first bids for the work. There is therefore no way of estimating the amount in excess of government commitment which the Town will have to pay. In the light of present inflation the result may well be economic hardship to the townspeople.

3. The Project tends to upset the traditional balance between the recreational and commercial boating interests.

4. No study has been made of the impact on the Town of the completed project; of how the increased commercial activity will affect the abutting land values; the effect of increased use of the road by heavy vehicles; and the demand for increased Town services in the years to come.

The Little Compton Planning Board therefore opposes the Sakonnet Harbor Project as ill conceived.

Sincerely,

Robert P. Buben

ROBERT BUBEN, Chairman

CC: Col.W.E.Hogdson,Jr., Acting Division Engineer
U.S.Army Corps of Engineers, New England Division
424 Trapelo Road
Waltham, MA 02254

3-91

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

January 7, 1981

William E. Hodgson, Jr.
Colonel, Corps of Engineers
Acting Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Re: Sakonnet Harbor, RI
Draft Detailed Project Report

Dear Colonel Hodgson:

We have reviewed the Draft Detailed Project Report concerning the feasibility of providing navigation improvements in Sakonnet Harbor in the interest of commercial navigation and related purposes.

We do not expect any significant adverse impacts associated with the proposed construction of a breakwater and access channel to service the commercial fishing facilities.

We have no objections to the proposed plan of improvement. This plan consists of a 500-foot rubble mound breakwater and a channel 10 feet deep and 110 feet wide running from deep water in the Sakonnet River to an area at the head of the harbor where new commercial docking facilities are planned by local interests.

Sincerely,

Allen J. Ikalainen

Allen J. Ikalainen
Chief, Special Permits Development Section

cc: USF&WS - Concord, NH
NMFS - Gloucester, MA

Town of Little Compton
Rhode Island

January 9, 1981

Colonel William E. Hodgson Jr.
Acting Division Engineer
New England Division, Corps of Engineers
424 Trapello Road
Waltham, Massachusetts, 02254

Dear Colonel Hodgson,

Thank you for extending for us until 12 January the opportunity to comment on your report "Sakonnet Harbor, Little Compton, Draft Detailed Project Report" dated November 1980.

As indicated in my earlier letter, we continue to have a problem with the width and alignment of the channel you have proposed. Your proposal will displace about 26 moorings without providing any additional space suitable for their relocation. See attachment #5. We are already short of moorings. You will recall that, in our initial request for this study, we expressed an interest in providing 70 additional mooring spaces.

While we are convinced of the impracticality of gaining additional mooring space under section 107 at this time and within a cost that the Town can afford, we do wish that every practicable step be taken to minimize the disruption to existing moorings. Accordingly we again recommend that the west channel boundary lie as close as possible to the breakwater and the existing docks without threatening their stability or precluding docking a boat at the outboard end of the dock, and

that the channel be narrowed to 80'. See attachment 6.

This proposed channel alignment and width is acceptable to our fishermen. It would reduce the moorings that have to be moved to about 20. It would create space into which some of them could be moved. The remainder we expect to be able to reset by making more efficient use of the remaining better protected mooring space.

This change contemplates maintenance dredging of both sand and rock to maintain the present 8' project depth along the breakwater and off dock # 79 not chargeable to the project and thus will reduce the total yards of federal and local dredging assignable to the project modification. See Drawings "Condition Survey" dated July 1977 by Charles L. Rowley and Associates and "Location of Rock Area" August 1977.

Sincerely yours,

Jane P. Cabot

President, Town Council

Attachments:

5 Photo of Harbor w/ moorings, 1974
6 Channel realignment and width
   a. Condition Survey, July 1977, Charles L. Rowley
   b. Condition Survey, Sheet 2, August 29, 1977

Town of Little Compton
Rhode Island

January 23, 1981

Colonel William E. Hodgson Jr.
Acting Division Engineer
New England Division, Corps of Engineers
424 Trapello Road
Waltham, Mass 02254

Dear Colonel Hodgson,

The Town Council at its meeting held last evening took under consideration a letter (dated January 6, 1981) from the Little Compton Planning Board. This letter was hand delivered to me as President of the Town Council on January 13, 1981.

I have been told by Mr. Buben, Chairman of the Planning Board, that he hand delivered this same letter to the Corps on January 12, 1981.

By a four to one vote of the Town Council at its regular meeting, I am instructed to inform you that the position taken by the Planning Board is not the position of the Town Council. The Planning Board, like the Harbor Advisory Board, is an advisory board to the Town Council. Their letter merely represents the opinion of individual members of the Planning Board.

The Town Council, as stated in our letter to you dated December 22, 1980, still requests that your office proceed expeditiously with preparation of the detailed plans and specifications for the Sakonnet Harbor Project. The Harbor Board will continue to be the Council's advisory board concerning this Project.

Sincerely,

Jane P. Cabot

President, Town Council

cc. Little Compton Planning Board
Little Compton Harbor Advisory Board

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEDPL-C

30 January 1981

Ms. Jane P. Cabot
President, Town Council
Little Compton, RI 02837

Dear Ms. Cabot:

I am responding to your letters of 22 December 1980, 9 January 1981, and 23 January 1981. Your December letter indicated general support for the project, requested us to proceed with detailed plans and specifications for the project, and included the town's comments to the Sakonnet Harbor Draft Detailed Project Report dated November 1980. The 9 January 1981 letter provided an additional request for a narrower channel aligned more closely with the existing breakwater. We have also taken note of your 23 January 1981 letter that the Planning Board is not speaking in an official capacity for the town of Little Compton. Therefore, assuming we can clarify your concerns in regard to the channel dimensions, we will be in a position to submit the report to Washington in February 1981.

We appreciate the depth of your review. Many of your comments will make the final report a tighter, more readable document. Inclosed are our responses to your comments.

I would also like to add that it has been a pleasure to work with the citizens of Little Compton. Should you have any questions, please feel free to contact me at (617) 894-2400, extension 222. Mr. Andon of my staff coordinated the investigation. Should your staff desire additional information, he can be reached at extension 550.

Sincerely,

WILLIAM E. HODGSON, JR.
Colonel, Corps of Engineers
Acting Division Engineer

Incl
As stated

Comment 1 - This office, during the investigation, determined that the optimum width of the channel should be 110 feet. The optimum plan was developed utilizing both economics and safety. While we have the authority to select a plan which does not maximize benefits, we do not have the authority to implement a plan that does not meet minimum safety standards. As the minimum safety dimensions were determined to be 110 feet, the recommendation must stand.

We have, however, developed a compromise solution which will hopefully satisfy all interests within the town. Upon completion of the project, it is suggested that the town of Little Compton petition this office for the right to utilize 30 feet of the access channel width as mooring space during the summer months only and convert the access channel back to its recommended dimensions for the remainder of the year. Implementation of this system will allow for minimum disruption of recreational mooring, while insuring this office that appropriate dimensions will be available during the more severe weather months.

As verbally indicated on a number of occasions, this office will attempt to align the channel as far west as possible. The final alignment, however, will not be determined until the completion of plans and specifications, at which time we will permit the town ample opportunity to review the final alignment. As the rock offshore of lot 79 is considered a maintenance item, the improvement report did not deal with this particular problem. Our office will, however, locate and remove any and all rock within this area at the time of construction on the access channel with no assessment to the improvement project.

Comment 2 - The figure 300 feet is incorrect and should read 450 feet.

Comment 3 - Agreed.

Comment 4 - Appendix 3 of the report will include all pertinent information. The recent commitment by the state will be included to reflect the new situation.

Comment 5 - The statement has been added, with the exception of the name H.W. Wilcox, on page 2-22 under the section titled "Other Effects."

Comment 6 - "miles" has been changed to "acres."

Comment 7 - The paragraph has been deleted and the suggested paragraph substituted.

Comment 8 - As the Normandeau report was based on and utilized MWL, it was decided to retain the designation.

Comment 9 - Same as Comment 8.

Comment 10 - The error has been corrected.

Comment 11 - Plans A and C should read yes, Plan B however as of the writing of this report does not require non-Federal funds to construct the project as planned.

Comment 12 - The correction has been made.

Comment 13 - The attachment has been included.

Comment 14 - Agreed. Our Engineering Division staff has been notified and will attend to this during preparation of the detailed plans and specifications.

Comment 15 - Agreed. The necessary corrections have been made. There is no need for additional disposal areas.

Comment 16 - The boundary of site 3 is admittedly different from that described in the report. I would like to point out, however, that when the town requests a permit from this office to construct the facility, our Regulatory Branch will be notified of the slight discrepancy.

Comment 17 - Agreed.

SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

ENGINEERING INVESTIGATIONS, DESIGN AND COST ESTIMATES

APPENDIX 4

PREPARED BY THE

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

ENGINEERING INVESTIGATIONS, DESIGN AND COST ESTIMATES

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ENGINEERING INVESTIGATIONS, DESIGN AND COST ESTIMATES

SECTION A

BREAKWATER DESIGN FACTORS AND ANALYSIS

Statement of the Problem

1. The principal difficulties attending navigation in Sakonnet Harbor stem from the exposed position of the harbor to ice floes and storm waves generated by prevailing winds from the northwest and the lack of adequately protected anchorage for the fishing fleet, both present and prospective.

Design Criteria

2. The proposed 500-foot rubble-mound breakwater, located on a bearing of South 62^{o} West, is designed to provide a protected harbor sufficient to accommodate the present and prospective fishing fleet. The alignment was selected to minimize the quantity of stone required for construction and to form, in conjunction with the existing breakwater, an effective entrance width into the harbor of 325 feet. The orientation of the structure is also designed to limit the height of diffracted waves that enter the harbor from northwest storms to less than 1-1/2 feet behind the breakwater. However, the alignment will not effectively reduce wave heights in a small portion of the northern part of the anchorage when the waves approach and enter the harbor between the breakwaters from the southwest. This portion of the anchorage could experience waves whose heights will be equal to or as much as 1.2 times the incident wave height when the wave's direction is from the west and southwest. On infrequent occasions, when storm waves approach from westerly and southwesterly directions, it may be necessary to move fishing and recreational craft out of the northern portion of the anchorage that is adversely affected by these waves.

Tides

3. Tides in the project area are semi-diurnal. Mean and spring tide ranges in Sakonnet Harbor vary from 3.3 feet to 4.1 feet, respectively.

Tidal Currents

4. Tidal currents in the Sakonnet River, as given by the National Ocean Survey "Tidal Current Tables for 1980, Atlantic Coast of North America," are very weak and variable.

Prevailing Winds

5. United States Weather Bureau wind records at Block Island, Rhode Island, the former weather station located about 25 miles southeast of and nearest the project site, were obtained for a 10 year period from 1936 to 1945. A wind rose diagram based on these observations is shown on Plate 4-14. It is considered that winds prevailing at Sakonnet Harbor are similar to those at Block Island. The records indicate that the prevailing winds are from northwesterly and westerly directions with the greatest duration from the northwest. Inasmuch as Sakonnet Harbor faces open water from the northwest counterclockwise through the southwest, wave action affecting the area must be generated by winds from these directions. It has been reasonably estimated that during intense storms from the northwest and southwest directions, wind velocities of 50 and 45 miles per hour, respectively may be experienced. The duration of these storm winds has been estimated to be about 12 hours.

Design Tide

6. The design tide is the highest tide which is estimated to occur in the project area on an average of once a year. A tide of 2.8 feet above mean high water or 6.1 feet above mean low water is considered to be the highest tide estimated to occur on an average of once a year and has been selected as the design tide height for design of the breakwater.

Design Waves

7. The height of design waves used are the highest significant waves which could be expected to occur at the trunk and head portions of the breakwater at the time of design tide. The breakwater trunk will be exposed principally to waves generated by storm winds blowing from the northwest and the breakwater head will be subjected to waves generated by storm winds from the west--southwest. An analysis was made of the National Ocean Survey Charts 13221 and 13218, which show Sakonnet Harbor and surrounding waters, and of wind records in the area as described in paragraph 5 of this Appendix, to determine the height of design waves. This analysis revealed that waves aproaching the breakwater trunk from the northwest would have a fetch of about 7 statute miles and those approaching the breakwater head from the west-southwest would have a fetch of about 50 statute miles. Computations for waves approachng the

breakwater trunk from the northwest, based on an average water depth of 35 feet, a 50 mile per hour wind speed and a straight line fetch of 7 statute miles, result in an estimated wave height at the breakwater of 5.0 feet with a wave period of 4.5 seconds. Observations by local residents confirm this estimated wave height from the northwest direction. This 5-foot wave is effectively reduced by diffraction to less than 1-1/2 feet in the anchorage area behind the breakwater. Deep ocean waves approaching the breakwater head and harbor entrance from west-southwest storms have been computed to be about 12 feet with a wave period of 7.5 seconds, based on a unrestricted fetch of 50 statute miles, a 45 mile per hour wind speed and a 12 hour duration. This 12-foot deep ocean wave is reduced by refraction and shoaling to 9 feet at the breakwater head and harbor entrance. Diffraction studies reveal that, under these conditions, waves immediately behind the harbor entrance in the northern portion of the anchorage could be in the order of 9 to 10 feet. Wave refraction and diffraction diagrams are shown on Plates 4-1 through 4-3.

Weights and Slopes of Stones in Breakwater

8.a. General: Based on experience for similar structures placed in similar environments. Slopes of 1.0 vertical and 1.5 horizontal for the trunk portion and 1.0 vertical and 2.0 horizontal for the head portion of the breakwater have been selected as being the most effective and economical. It has been assumed that stone will be obtained from a commercial quarry in Tiverton, Rhode Island. The quarry is located approximately 10 nautical miles upstream of the project site and has access to loading facilities located on the Sakonnet River. Stone from this source is granite weighing 165 pounds per cubic foot. The breakwater design is based on the use of rough armor stone, individually placed, in two layers. The average weights of armor stone have been determined from the U.S. Army Coastal Engineering Research Center (CERC) guide equation shown in their "Shore Protection Manual" as follows:

$$W = \frac{WrH^3}{K_d(Sr-1)^3 \text{Cot } \theta}$$

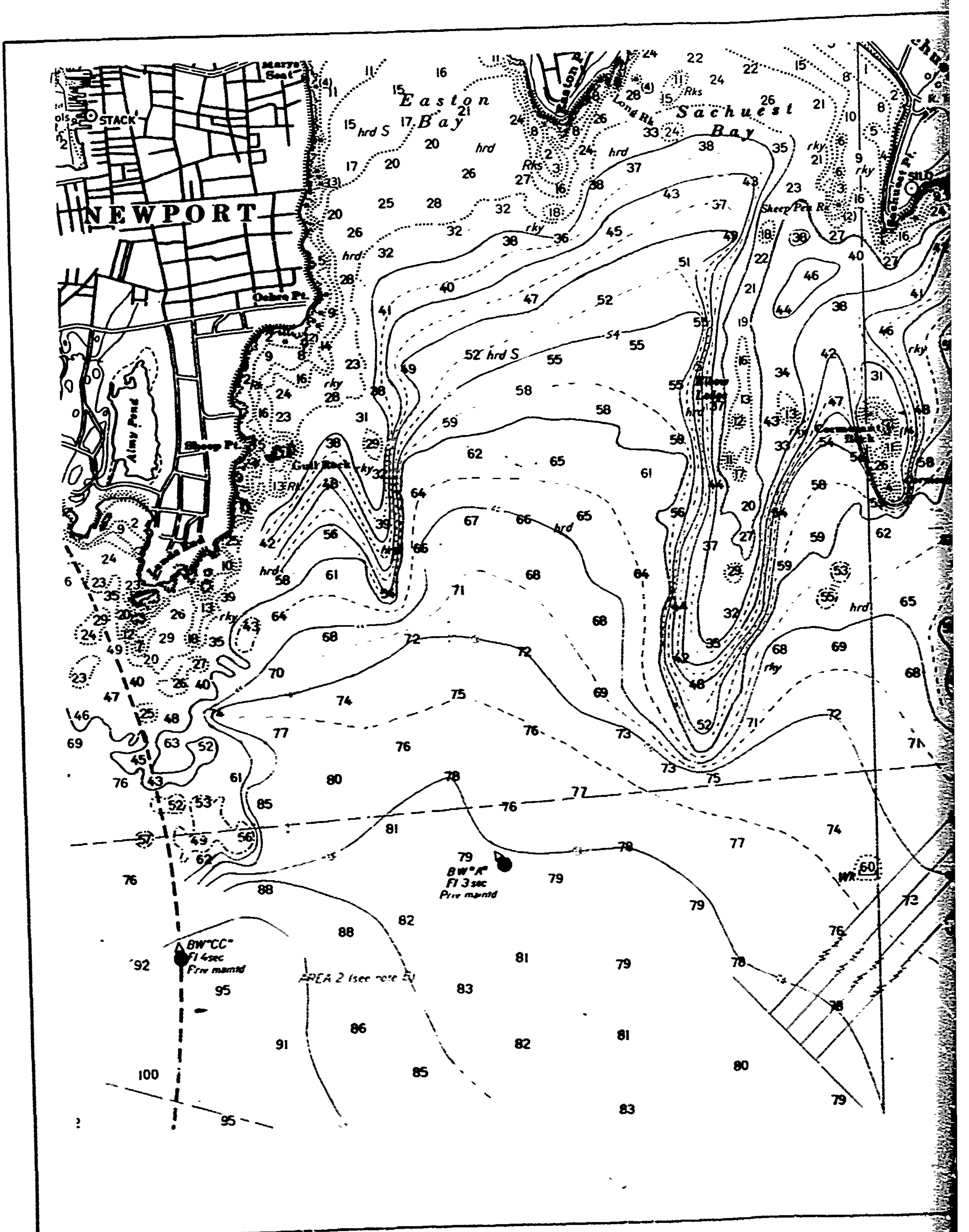
Where:

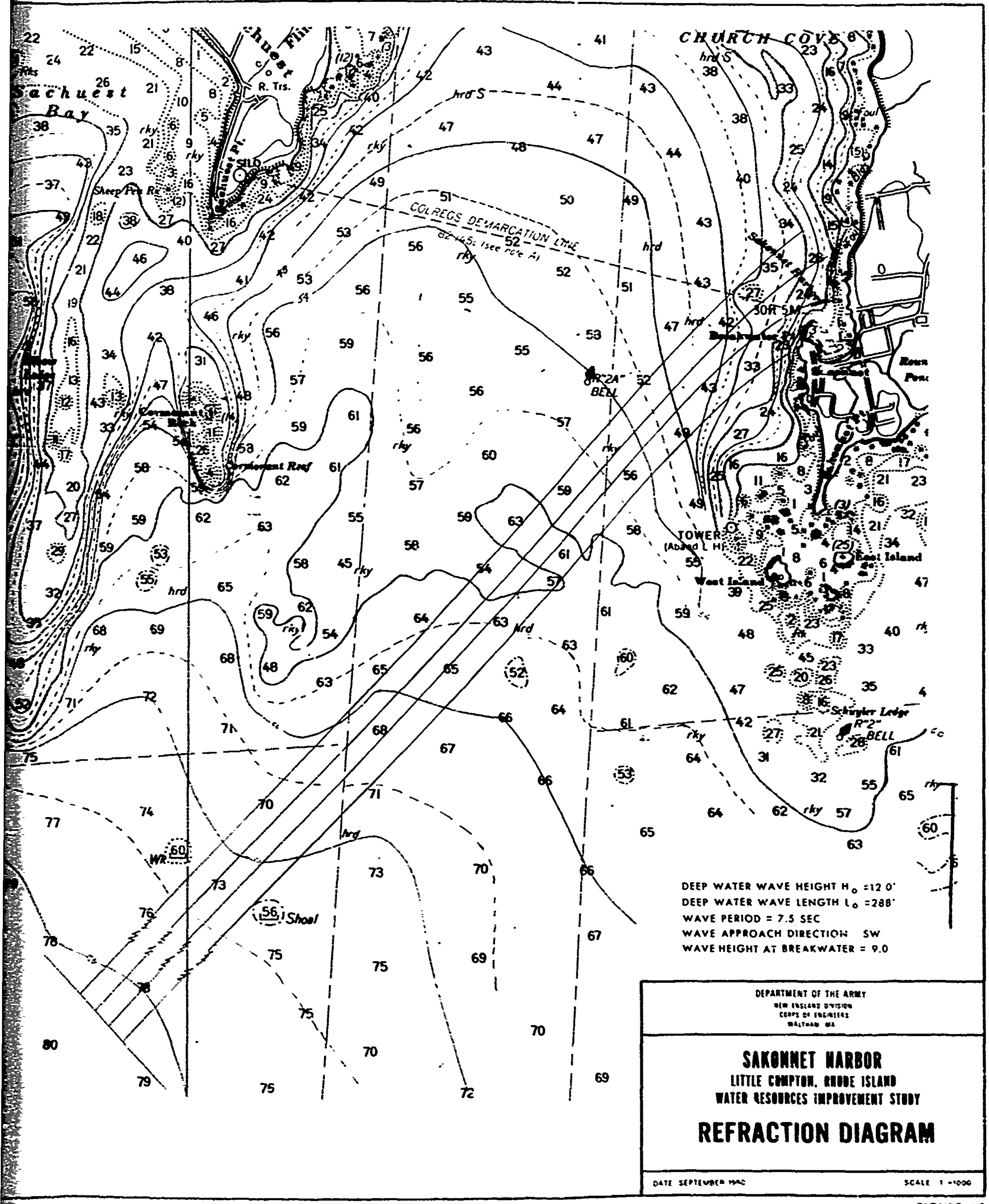
- W = Weight of armor stone in pounds
- Wr = Unit weight of armor stone in lbs/ft^3
- H = Design wave height at the structure in feet
- Sr = Specific gravity of armor stone relative to the water at the structure (Sr=Wr/Ww)
- Ww = Unit weight of sea water = 64.0 lbs/ft^3
- θ = Angle of structure slope measured from horizontal in degrees
- K_d = Stability coefficient that varies primarily with the shape of the armor stone, roughness, and degree of interlocking obtained in placement.

The minimum and maximum weights of all armor and underlayer stone were computed to be about 75 and 125 percent, respectively, of the calculated average stone weights. The underlayer stone and the slope stone layer below the armor stone layer were designed to contain average stone sizes equal to about 10 percent the weight (W) computed for the armor stone layer. All core stone will be quarry run. Since two-thirds of the breakwater is below water, and the core stone will be loosely placed, general loosening of the armor and bedding stone, after placement, will result. Therefore, K_d coefficients of 3.5 and 2.5, respectively, have been used for the determination of stone sizes rather than the higher values of 4.0 and 2.8 recommended in the manual. The bottom of the armor stone on the river side has been established at an elevation of about 1.5 times the design wave height below the design stillwater level and at an elevation below the design stillwater level equal to one times the design wave height on the harbor side. As noted in paragraph 9 below, the foundation soils consist of firm sands and gravels, therefore, no filter blanket is considered necessary.

b. Trunk Section: The weight of the armor stone for the trunk portion of the breakwater, based on a 5-foot design wave, slopes of 1 on 1.5, a stone unit weight of 165 pounds per cubic foot, and a K_d coefficient of 3.5, was calculated to be 1,000 pounds. Based on the assumption that the stones are cubical in shape, the stones would measure 2.1 feet on a side. The thickness, therefore, of the armor stone, based on a two stone thick layer, is 4.2 feet, say 4.0 feet. The range of armor stone sizes, based on values of 0.75W and 1.25W for minimum and maximum sizes, respectively, is 750 to 1250 pounds. At least 75 percent of the stones will weight 1,000 pounds. The 2-foot thick underlayer stone and the 6-foot thick stone layer forming the outer slope of the breakwater trunk below the armor stone layer, were designed to contain stone sizes ranging from 50 to 125 pounds, with at least 75 percent of the stones weighing 100 pounds (W/10). The core stone will be quarry run containing assorted sizes up to 100 pounds, with at least 50 percent of the stones weighing 30 pounds. The 30-pound average size is somewhat greater than the W/200 size recommended by the manual, but was selected to be consistent to that required for the head section.

c. Head Section: The weight of the armor stone for the head section, based on a 9-foot design wave, a 1 on 2 slope, a stone unit weight of 165 pounds per cubic foot, and a K_d coefficient of 2.5 was calculated to be 3 ton. The theoretical size of a 3 ton stone is 3.81 feet on a side; therefore, the required two stone layer thickness is 7.6 feet, say 7.5 feet. The armor stone layer will contain stone sizes ranging from 2 to 4 ton with at least 75 percent of the stone weighing 3 tons. The bedding stone layer and the stone layer forming the outer slope of the breakwater below the armor stone layer, 3.5 and 11.0 feet thick, respectively, were designed to contain stone sizes ranging from 300 to 750 pounds, with at least 75 percent of the stones greater than 600 pounds. Core stone will be quarry run containing assorted sizes up to 100 pounds, with at least 50 percent of the stones weighing 30 pounds (W/200).


NEWPORT
STACK
Easton Bay
Sachuest Bay
Long Rk
Sheep Pen Rk
Ochre Pt.
Almy Pond
Sheep Pt.
Gull Rock
Cormorant Rock
SILO
BW "R"
Fl 3 sec
Priv maintd
BW "CC"
Fl 4sec
Priv maintd



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MA

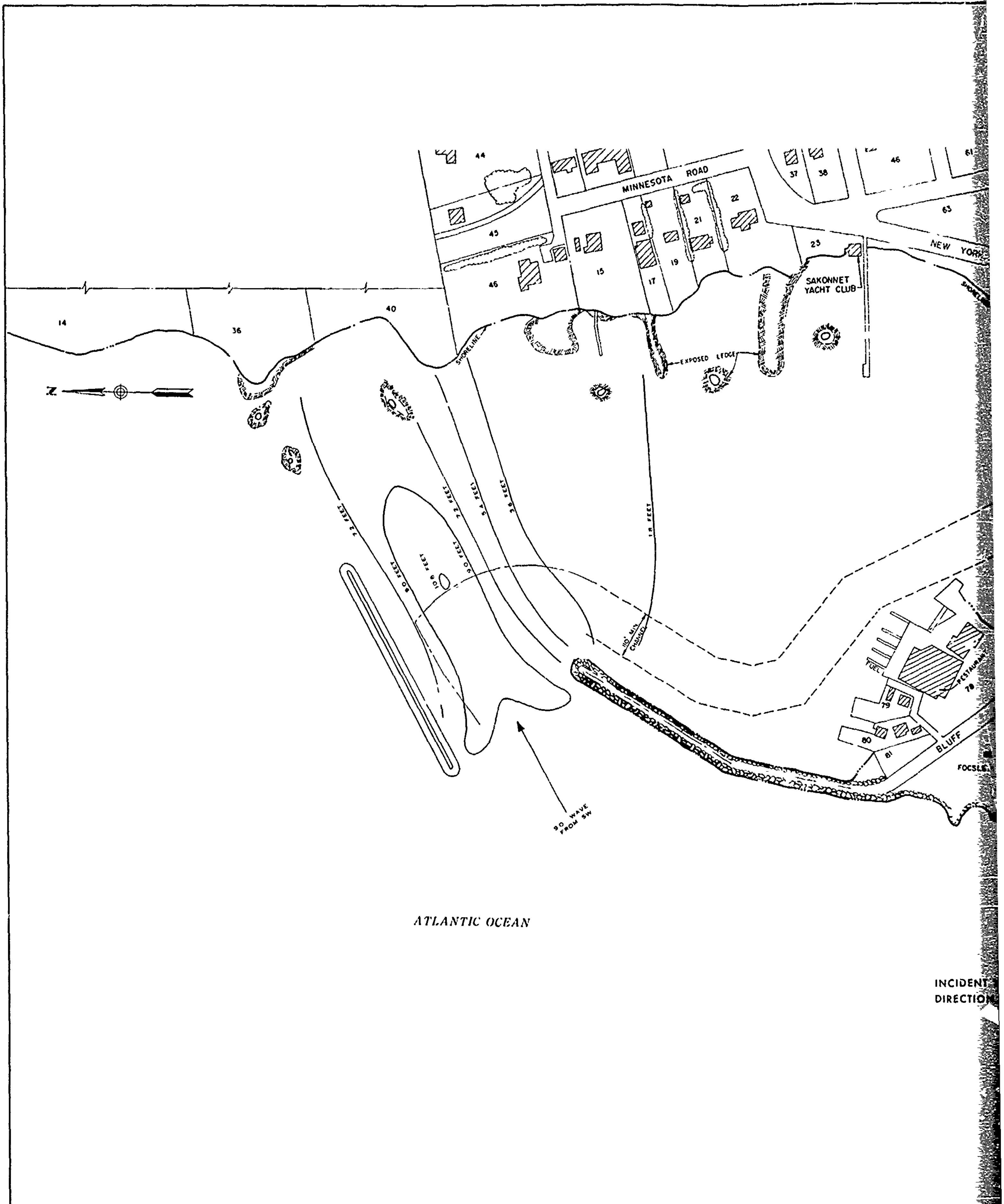
SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

REFRACTION DIAGRAM

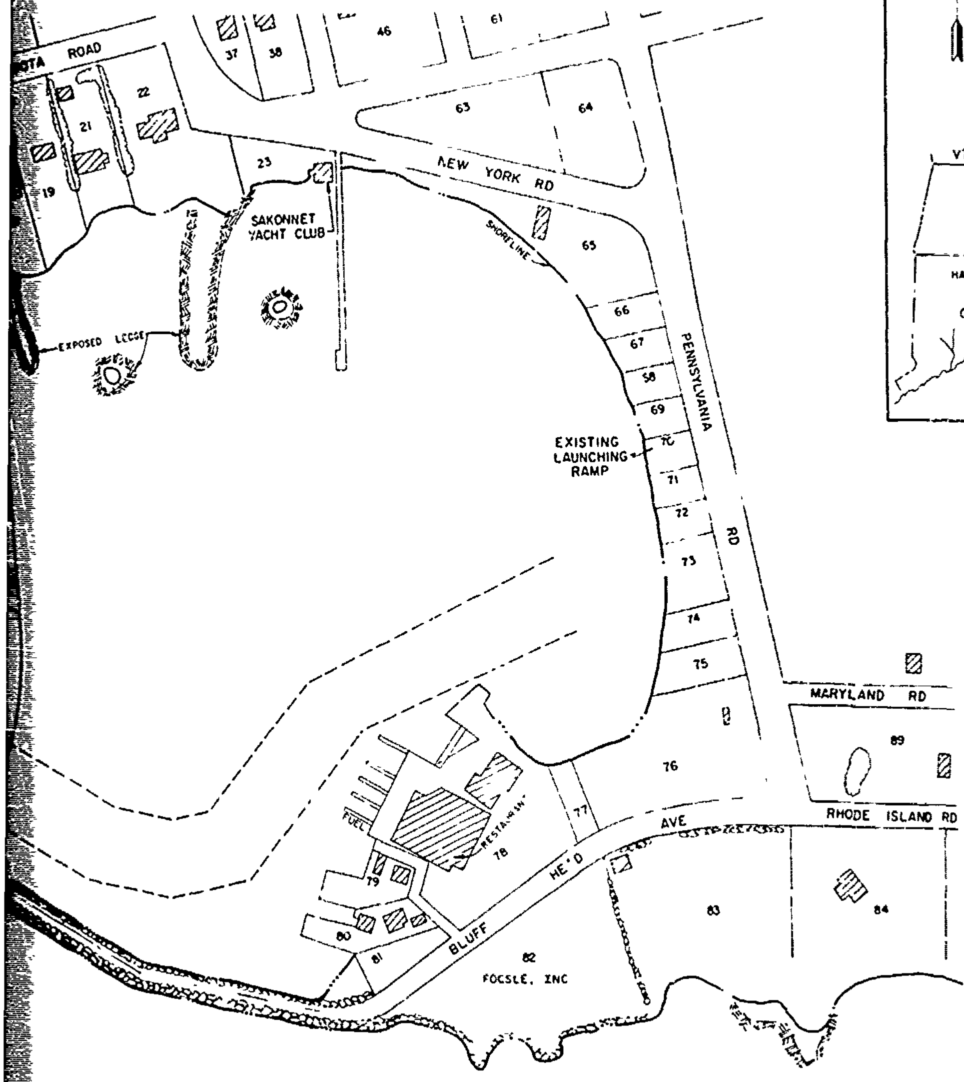
DATE SEPTEMBER [illegible] SCALE [illegible]

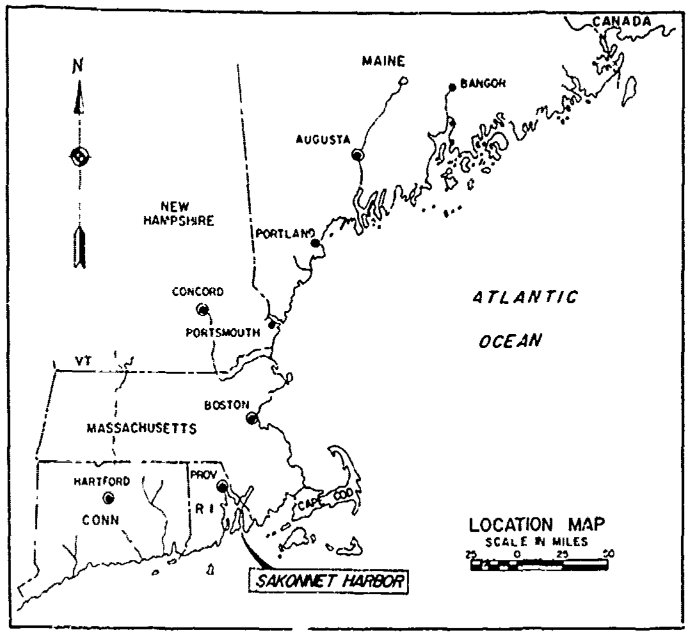
FIGURE 4-1

2



MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
7.2 FEET
8.0 FEET
10.8 FEET
9.0 FEET
7.2 FEET
5.4 FEET
3.6 FEET
1.8 FEET
110' MIN. CHANNEL
9.0 WAVE FROM SW
FUEL
RESTAURANT
BLUFF
FOCSLE
ATLANTIC OCEAN
INCIDENT
DIRECTION





INCIDENT WAVE HEIGHT = 9.0'
DIRECTION OF WAVE APPROACH-SW

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM MA

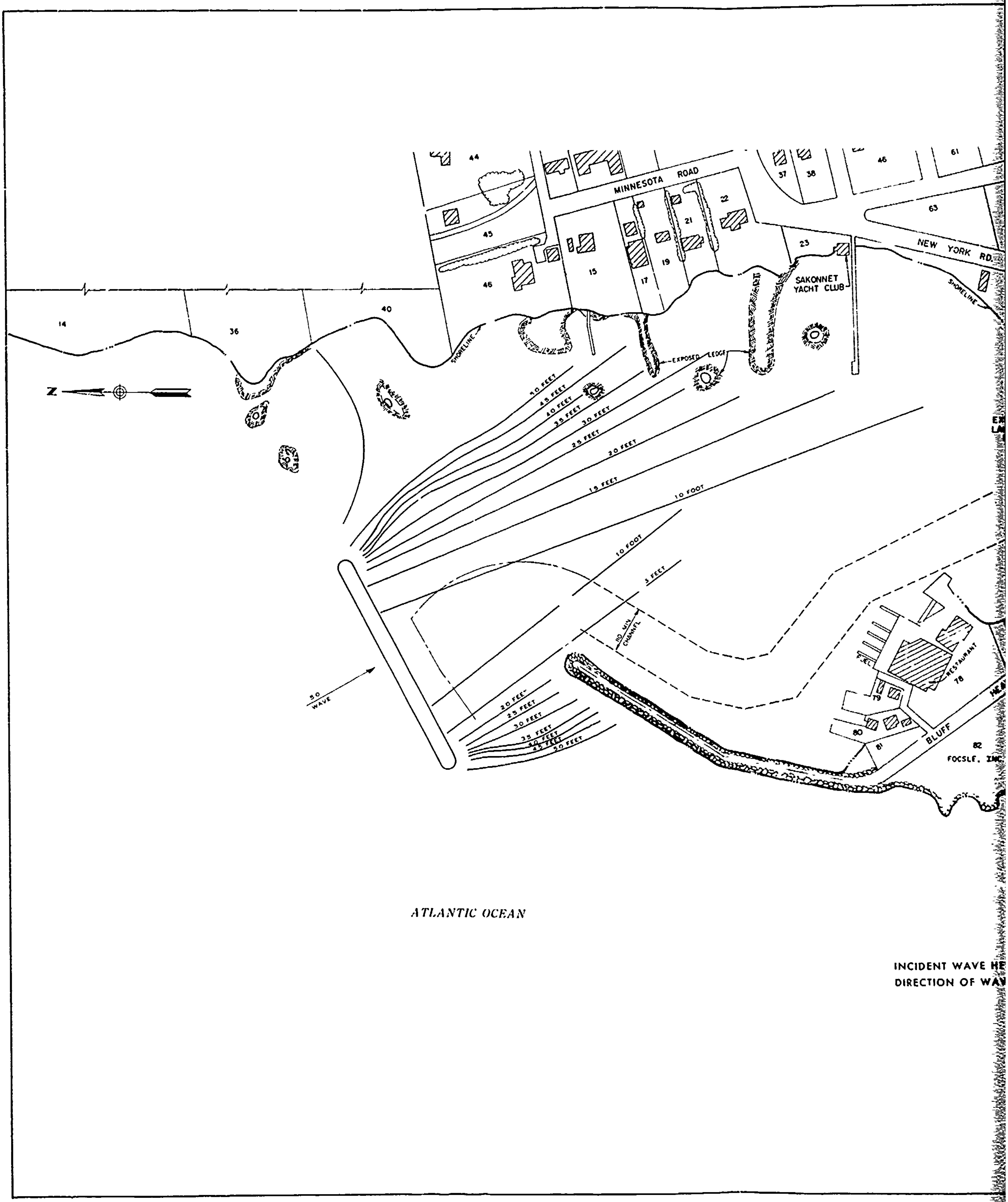
SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

DIFFRACTION DIAGRAM

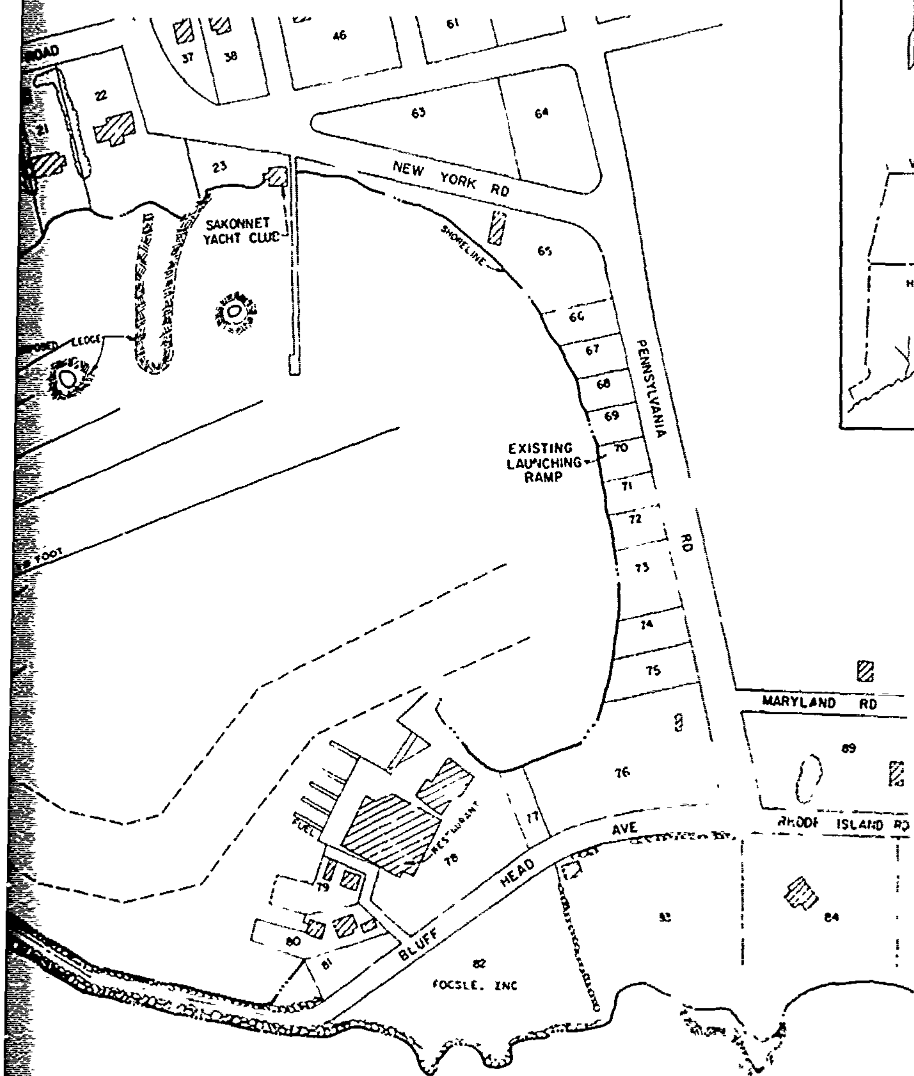
DATE SEPTEMBER 1980 SCALE 1 =100

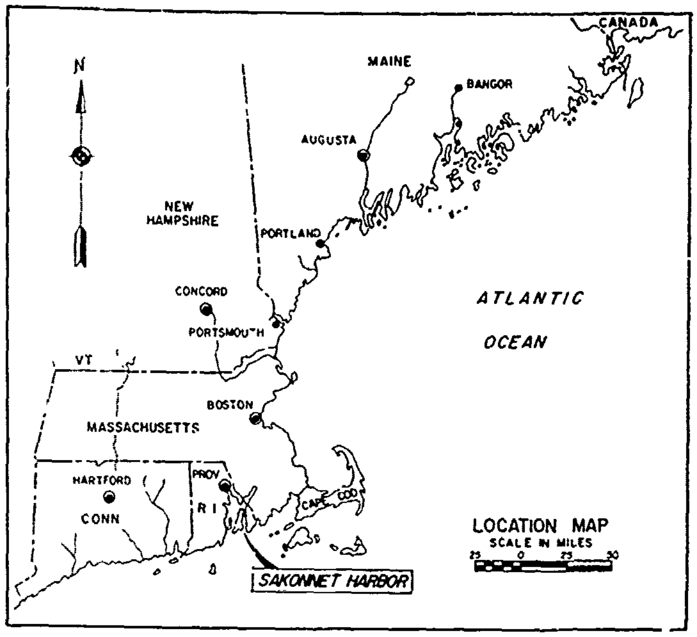
FIGURE 4-2

2



44
MINNESOTA ROAD
37
38
46
61
63
NEW YORK RD.
45
22
21
19
17
15
46
23
SAKONNET YACHT CLUB
SHORELINE
14
36
40
EXPOSED LEDGE
50 FEET
45 FEET
40 FEET
35 FEET
30 FEET
25 FEET
20 FEET
15 FEET
10 FOOT
10 FOOT
5 FEET
110 MIN. CHANNEL
50 WAVE
20 FEET
25 FEET
30 FEET
35 FEET
40 FEET
45 FEET
50 FEET
RESTAURANT
78
79
80
81
82
BLUFF
ATLANTIC OCEAN
INCIDENT WAVE
DIRECTION OF





INCIDENT WAVE HEIGHT = 5.0'
DIRECTION OF WAVE APPROACH — N W

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM MA

SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

DIFFRACTION DIAGRAM

DATE SEPTEMBER 1980 | SCALE 1"=100

FIGURE 4-3

d. Transition Zone Between Trunk and Head Section: Stone sizes selected for the transition zone between the trunk and head sections were designed to range between the maximum size stone of the trunk section and the minimum size stone of the head section.

Crest Elevation and Width

It has been determined, by use of Figure 7-20 of the Shore Protection Manual, entitled "Comparison of Wave Runup on smooth slopes with runup on Permeable Rubble Slopes (data for d_s/Ho greater than 3.0)", and on the basis of a 4.5 second period deep water wave, a 5.0 foot design wave and a 1 on 1.5 structure slope, that the wave run-up at the breakwater would be in the order of 4.3 feet. This vertical height when added to the maximum stillwater level of 6.1 feet above m.l.w. results in a storm wave run-up to an elevation of 10.4 feet at the proposed breakwater. It is concluded, however, that the top of the breakwater be set at 8.0 feet above mean low water for the following reasons:

(1) The overtopping of the breakwater by the wave run-up of 2 to 2.5 feet above the crest of the breakwater would not have a significant effect on the wave action within the protected anchorage.
The width of the breakwater crest along the trunk section is designed to accommodate at least three-1,000 pound stones which amounts to 6.0 feet. However, an 8-foot trunk width is provided to facilitate construction and for ease of maintenance of the slopes. The west end or head section is designed for a three-3.0 ton stone width which amounts to 11.4 feet, say 12.0 feet. The design calls for a 150-foot transition from the 8 to the 12-foot widths.

Breakwater Foundation

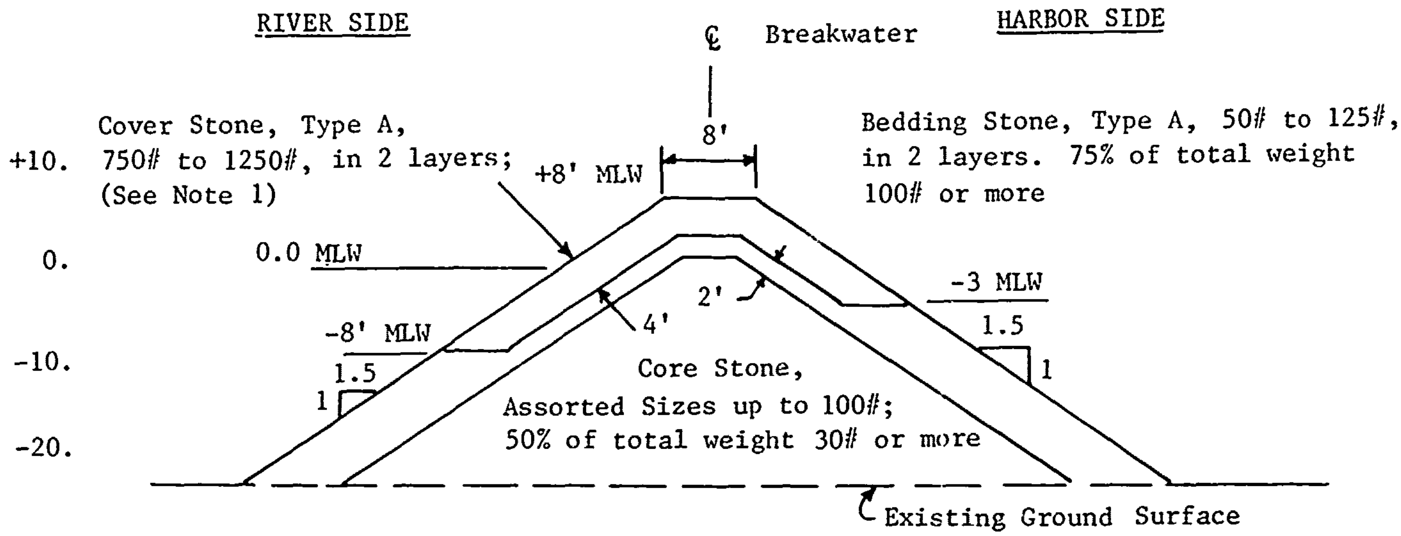
9. Three borings were made along the proposed breakwater alignment in March, 1977. The borings indicate the foundation soils to consist of firm sands and gravels with shell fragments.

SECTION B

CHANNEL CRITERIA

10. The proposed access channel will be 110 feet wide with a uniform depth of 10 feet mean low water. The channel will begin at the northern end of the existing west harbor breakwater and proceed in a southeasterly direction for a total length of 1,155 feet. The side slope design criteria for channel dredging in earth is 1.0 vertical and 3.0 horizontal. The side slope design criteria for channel excavation in rock is 1.0 vertical and 1.0 horizontal.

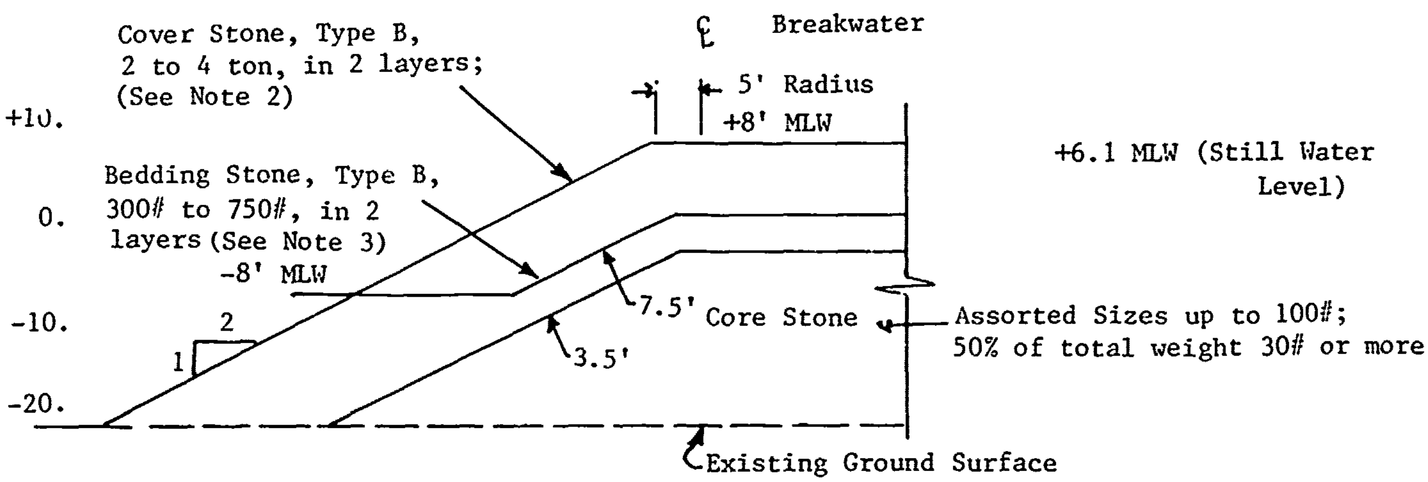
11. The water depth in the first 200 feet of channel varies from a maximum of 18.0 feet mean low water to a minimum depth of 10.0 feet mean low water. Therefore, dredging will not be required in this section of the channel. The depth of water in the remainder of the channel varies from a maximum of 10.0 feet mean low water to a minimum of 8.0 feet mean low water. The shallowest section of the channel is located at a point directly opposite the site of the proposed berthing facilities which are to be utilized by the offshore lobster boats. The maximum dredging effort will require the removal of a 3-foot cut, including a 1-foot overdepth in earth and a 2-foot overdepth in rock, and is restricted to the latter portions of the channel.



SECTION A-A

TYPICAL TRUNK BREAKWATER SECTION

Scale: 1" = 20'



SECTION B-B

TYPICAL HEAD BREAKWATER SECTION

Scale: 1" = 20'

Notes:

1. 75% of total weight 1000# or more
2. 75% of total weight 3 tons or more
3. 75% of total weight 600# or more
4. Provide slope transition from 1 on 1.5 to 1 on 2 and top width transition from 8 to 12 feet between Sta. 3+50 and 5+00;
5. Provide cover stone transition from Type A to Type B between Sta. 2+50 and 5+00
6. Provide bedding stone transition from Type A to Type B between Sta. 3+50 and 5+

50# to 125#,
al weight

e

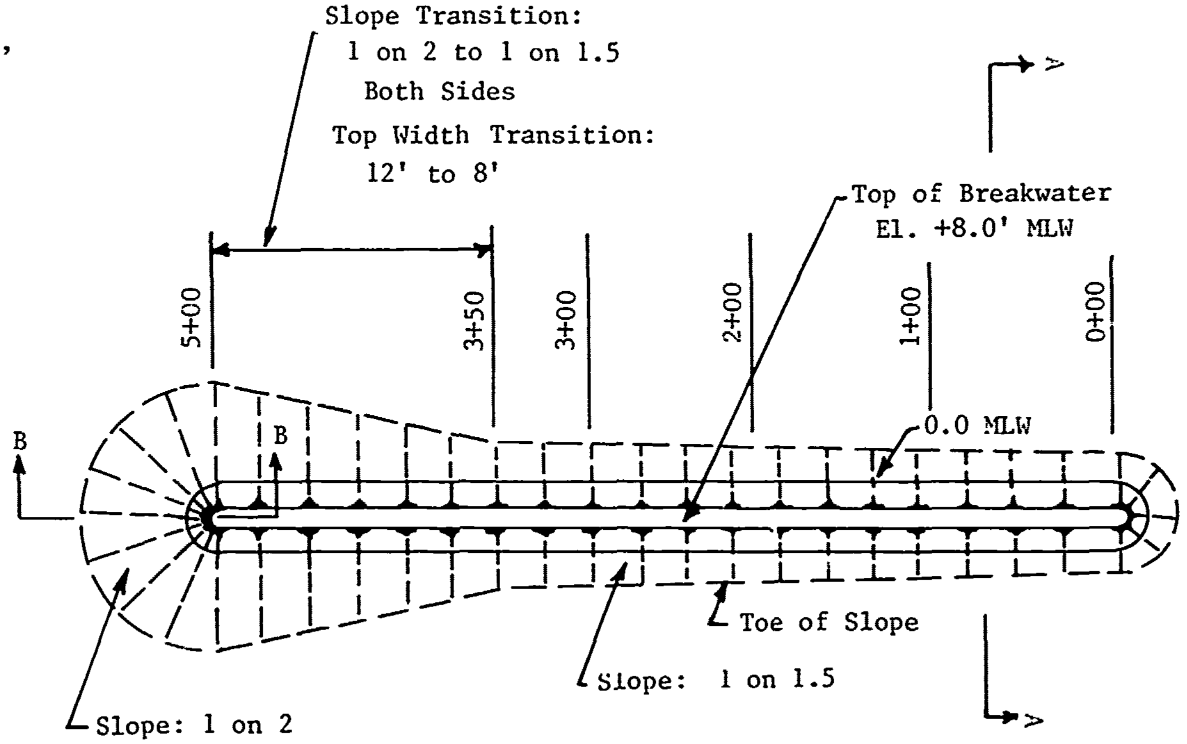
till Water
Level)

to 100#;
at 30# or more

transition from

Sta. 2+50 and 5+00
Sta. 3+50 and 5+00.

RIVER SIDE



HARBOR SIDE

PLAN OF BREAKWATER

Scale: 1" = 100'

WATER RESOURCES IMPROVEMENT STUDY
SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND

BREAKWATER CROSS-SECTIONS

FIGURE 4-4	NOV. 1980

SECTION C

COST ESTIMATES

First Costs

12. Unit prices used in estimating project construction costs are based on 1 June 1980 price levels. Quantity estimates are based on hydrographic surveys made in June 1977 and explorations made in March 1977 and February 1978. Dredging of the channel will entail the removal of approximately 8,000 cubic yards of sand and gravel and 170 cubic yards of rock. Rock will be removed by bucket dredge, after drilling and blasting, and disposed of in deep water in the harbor. The sand and gravel material will be removed by a 12-inch hydraulic pipeline dredge and disposed of on the two land lots shown on Figure 4-9. Retaining dikes will be approximately 6 feet high with a top width of 10 feet and side slopes of 1.0 vertical and 2.0 horizontal. Dredging quantities are based on in-place measurements and provide for removal to project depths below mean low water plus an allowance of one-foot overdepth in ordinary or sand and gravel material and two-foot overdepth in rock. Side slopes for the channel will be 1.0 vertical to 3.0 horizontal in earth and 1.0 vertical and 1.0 horizontal in rock.

13. As noted previously in this report, it has been assumed that stone will be obtained from a commercial quarry in Tiverton, Rhode Island, approximately 10 nautical miles upstream of the project site. Stone will be delivered to the project site by bottom-dump scows and placed in the breakwater by bottom dumping and by a barge-mounted derrick lighter. Stone quantities are based on lean dimensions to the prescribed structure limits and on an in-place weight of 1.65 tons per cubic yard of breakwater volume of all breakwater stone. This assumes 25% void spaces between the breakwater stone.

14. Construction costs include an allowance of 12 percent contingencies for dredging of the channel and 15 percent contingencies for construction of the breakwater. Costs of engineering and design and of supervision and administration are based on experience, knowledge and evaluation of the project site, and comparison with similar projects in the general area.

The total first cost of the project is estmated at $1,800,000. A summary of current costs for the project features is given in Table 4-1. For a comparative summary of costs, a breakdown of the estimated construction costs of Plans A, B and C is provided in Appendix 5 Table 5-3.

TABLE 4-1
SUMMARY OF COSTS
(1 June 1980 Price Level)

Project Features	Estimated Cost
Channel	
Dredging Ordinary Material, 8,000 c.y. @ $13.00/c.y.	$104,000
Dredging rock, 170 c.y. @ $100./c.y.	17,000
Subtotal	$121,000
Contingencies (12%)	15,000
Total Dredging Cost	$136,000
Breakwater	
Cover Stone, Type A, 4,350 tons @ $29.00/ton	$126,000
Cover Stone, Type B and Transition Cover Stone Type A to Type B 3,790 tons @ $38.00/ton	144,000
Bedding Stone, Type A, Type B and Transition Bedding Stone, Type A to Type B, 19,225 tons @ $21.50/ton	413,000
Core Stone, 31,240 tons @ $19.00/ton	594,000
Subtotal	$1,277,000
Contingencies (15%)	192,000
Total Breakwater Construction Cost	$1,469,000
Engineering and Design	85,000
Supervision and Administration	110,000
Total Estimated First Costs	$1,800,000

SECTION D

PROJECT MAINTENANCE COSTS

15. Following initial construction of the project, the breakwater will require repairs and the channel will require periodic dredging. The breakwater may be expected to incur damage to the armor stone as waves of unusual severity strike the structure. Maintenance of the existing breakwater has required replacement of about 100 ton of armor stone annually. Since the stone sizes for the proposed breakwater will be much smaller than those on the existing breakwater, more movement of the stone is expected to occur. It is therefore considered reasonable to assume that the structure will require the replacement of about 200 tons of stone annually. Table 4-2 shows the estimated maintenance costs of the breakwater.

Table 4-2
Breakwater Maintenance Costs

Annual Replacement	=	200 Tons		
Replacement over 10 Years	=	2,000 Tons		
Annual Maintenance Cost	=	200 Tons	@ $75.00/Ton	= $15,000

16. Maintenance of the channel has been based on previous condition surveys which indicate an annual shoaling rate equal to 2 percent of the initial volume of dredged material. Based on the anticipated shoal rate of 2 percent, maintenance dredging would be required at 10 year intervals to maintain the necessary channel depths. Table 4-3 shows the costs associated with maintaining the proposed access channel dimensions.

TABLE 4-3
Channel Maintenance Costs

Annual Amount	=	160 c.y.		
Amount in 10 Years	=	1,600 c.y.		
Annual Maintenance Cost	=	160 c.y.	@ $15.00 c.y.	= $2,400

16. Maintenance of the channel has been based on previous condition surveys which indicate an annual shoaling rate equal to 2 percent of the initial volume of dredged material. Based on the anticipated shoal rate of 2 percent, maintenance dredging could be required at 10 year intervals to maintain the necessary channel depths. Table 4-3 shows the costs associated with maintaining the proposed access channel dimensions.

SECTION E

Alternative Disposal Sites

17. There are 5 possible sites for the disposal of the dredged material. Land sites 1, 2, and 3 are shown on Figure 4-9.

18. Sites 1 and 2 are lots designated 83, 75, and 76 respectively - town of Little Compton plot plan. The lots are on opposite sides of the foot of Bluff Head Avenue. Disposal site 1 covers an area of 1.0 acres and disposal site 2 covers an area of 0.6 acres. If the 8000 cubic yards from the Federal project is deposited at these sites the top of the dikes will average 6 and 5.25 feet above the existing ground level at disposal sites 1 and 2, respectively. If the dredged material from the Federal and private dredging projects is deposited at these sites the top of the dikes will average 12 feet and 10.25 feet above the existing ground level at disposal sites 1 and 2, respectively.

19. Disposal site 3 is an area in the southwest corner of the harbor. This site covers an area of approximately 0.6 acres. The dredged material would be deposited behind a bulkhead wall along the shoreline at this location. If the 6000 cubic yards from the private dredging project is placed at this site the bulkhead wall will have an elevation of 19 feet above MLW.

20. The fourth disposal option entails the use of an ocean site known as Brenton Reef. The advantages of this site are its proximity to the dredge site and its previous history of use. There is more scientific information regarding this site than any other in the area. However, there is the concomitant disadvantage of historic opposition to dumping at this site.

21. The final disposal option would utilize an ocean site known as the Sakonnet Harbor Dump Ground. This open water site was considered for the original Sakonnet Harbor Project but not used. It is a 3/4 mile square site in Narragansett Bay, located and described as follows:

Beginning at a point one mile due west of Breakwater Point Light in Sakonnet Harbor, thence due west 3/4 mile to a point; then due south 3/4 mile to a point; thence due east 3/4 mile to a point and thence due north 3/4 mile to the point of beginning and containing 360 acres. The depth of water ranges from 59 to 65 feet below mean low water. No scientific studies have been conducted at this site and its use for other disposal operations is unknown. Deposition of sand and gravel to be dredged from Sakonnet would not cause any adverse impacts to the ecosystem if dumped at this site.

At this time however, there is no State designated dumping grounds within the coastal waters of Rhode Island and ocean disposal of dredge material is considered on an individual project basic.

The town of Little Compton will be responsible for providing suitable and adequate dredge disposal sites and associated costs for proper diking of the condition of a local cooperation which was agreed to under the original project authorization.

Recommended Disposal Sites

22. As the nature of the dredged material is primarily sand, disposal will take place on land lots designated numbers 75, 76, and 83 on the town of Little Compton plot plan. The recommended disposal site is shown on Figure 4-9. As Figure 4-9 indicates, the lots are on opposite sides of the foot of Bluff Head Avenue. The area, designated Disposal Site 1, covers an area of 1.0 acres and will contain approximately 12,150 cubic yards of material. The top of the dike will average 12 feet above the existing ground level.

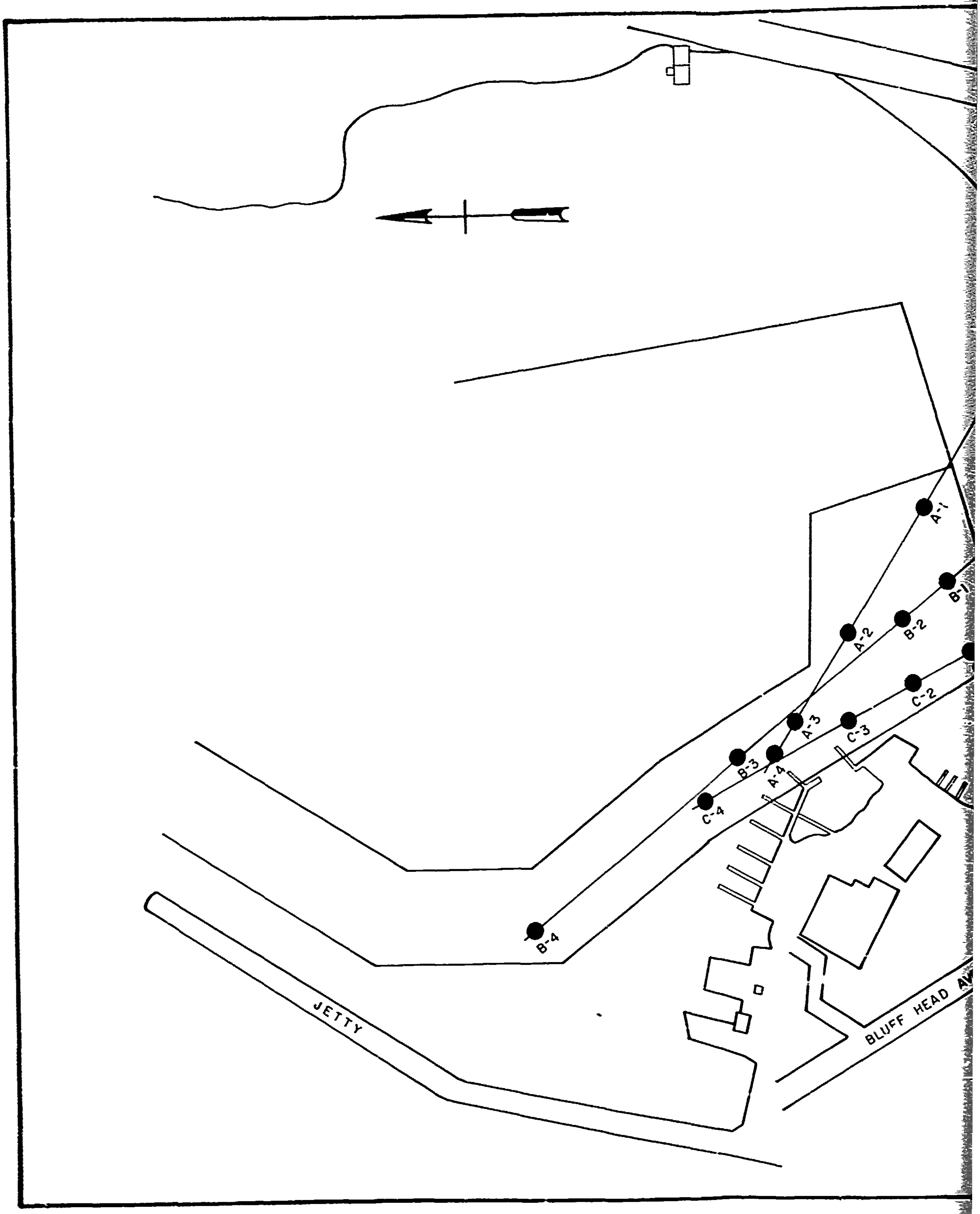
23. The area designated Disposal Site 2 covers an area of 0.6 acres and will accommodate approximately 7,860 cubic yards of material. The top of the dike will average 10.25 feet above the existing ground level.

24. The proposed dikes, will have a top width of 10 feet and side slopes of 1 vertical to 2 horizontal. As the dredged material is coarse in nature, rapid drainage and drying an be expected to occur. It should be noted, however, that local desires will be met during actual construction and that all attempts will be made to place and slope the material as they request.

SUBSURFACE TEST BORINGS

25. During the time period 7-11 March 1977, three test borings were taken along the proposed breakwater alignment. The borings indicated the bottom sediments to be composed of gravel and silty sand with shell fragments. In addition, two grab samples were taken within the harbor and usually classified as silty sandy gravel and silty fine sand respectively, with traces of organic material.

26. In February 1978, a total of 12 probes were taken along the proposed channel alignment, as shown in Figure 4-5. A log of the probes is presented in Figure 4-6 through 4-8. All of the probes were driven to a depth of -12 feet mean low water, as none of the probes met with refusal, channel construction should pose no difficulty for a hydraulic dredge.



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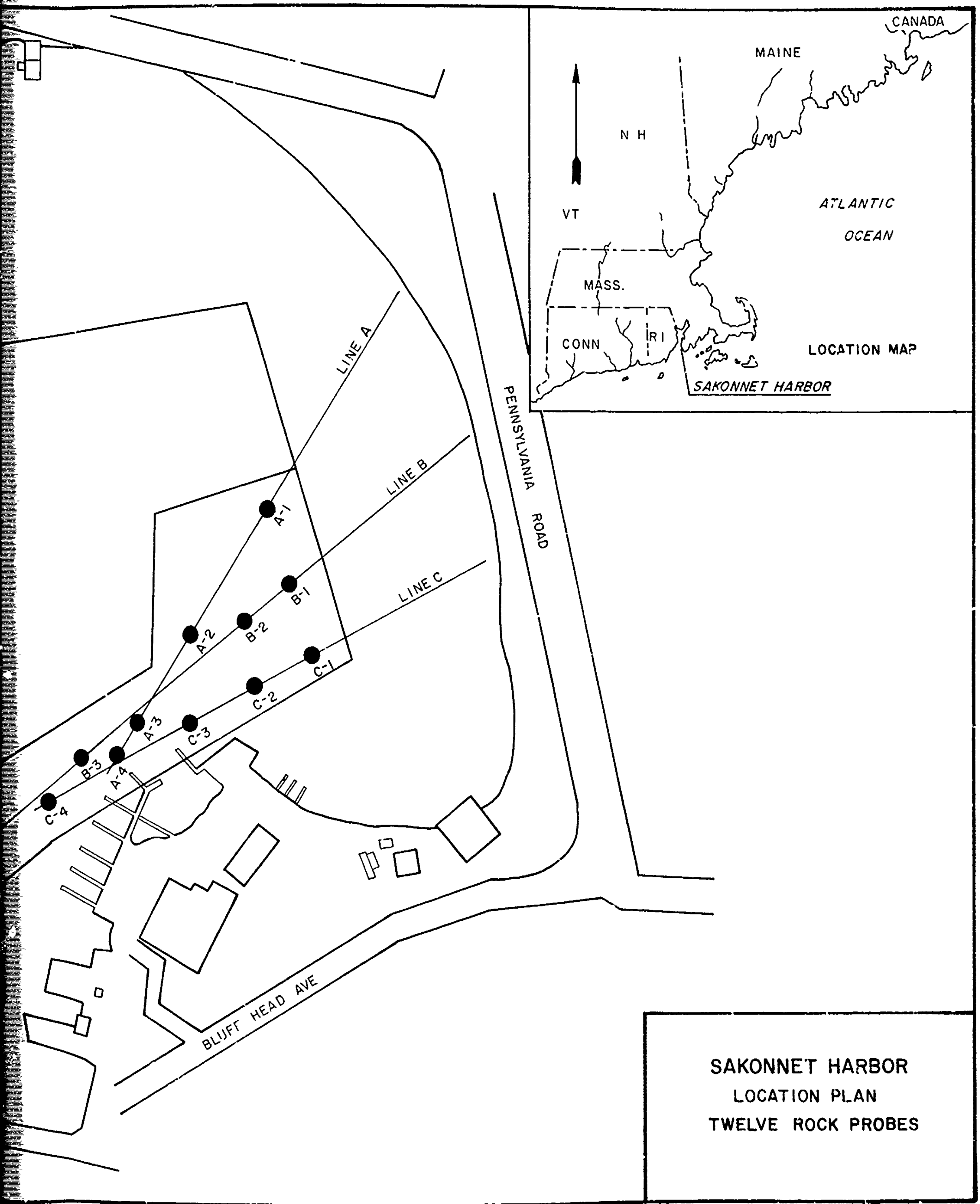


SAKONNET HARBOR
LOCATION PLAN
TWELVE ROCK PROBES

FIGURE 4-5

LOG OF PROBES
PROBE A

PROJECT: PROBES OF HARBOR BOTTOM

LOCATION: SAKONNET HARBOR, LITTLE COMPTON, R.I.

SIZE PROBE: AW ROD ($1\frac{3}{4}$" O.D.) HAMMER: 140 LBS. FALL: 30-INCHES

PROBE NO.	BOTTOM EL.(M.L.W.)	DEPTH BELOW BOTTOM						TOTAL LENGTH OF PROBE
		1′	2′	3′	4′	5′	6′	
		BLOWS PER FOOT						
A-1	−8.7	24	22	26	8/0.3′			3.3′
A-2	−9.5	19	37	21/0.5′				2.5′
A-3	−8.9	5	26	19	2/0.1′			3.1′
A-4	−9.6	16	29	13/0.4′				2.4′

NOTES: 1. ALL PROBES DRIVEN TO ELEV. −12.0 (M.L.W.)

FIG. 4-6

LOG OF PROBES
PROBE B

PROJECT: PROBES OF HARBOR BOTTOM

LOCATION: SAKONNET HARBOR, LITTLE COMPTON, R.I.

SIZE PROBE: AW ROD ($1\frac{3}{4}$" O.D.) HAMMER: 140 LBS. FALL: 30-INCHES

PROBE NO.	BOTTOM EL.(M.L.W.)	DEPTH BELOW BOTTOM						TOTAL LENGTH OF PROBE
		1′	2′	3′	4′	5′	6′	
		BLOWS PER FOOT						
B-1	−8.3	4	28	29	21/0.7′			3.7′
B-2	−9.2	4	14	33/0.9′				2.8′
B-3	−9.0	6	37	39				3.0′
B-4	−10.2	3	4/0.9′					1.8′

NOTES: 1. ALL PROBES DRIVEN TO ELEV. −12.0 (M.L.W.)

FIG. 4-7

LOG OF PROBES
PROBE C

PROJECT: PROBES OF HARBOR BOTTOM

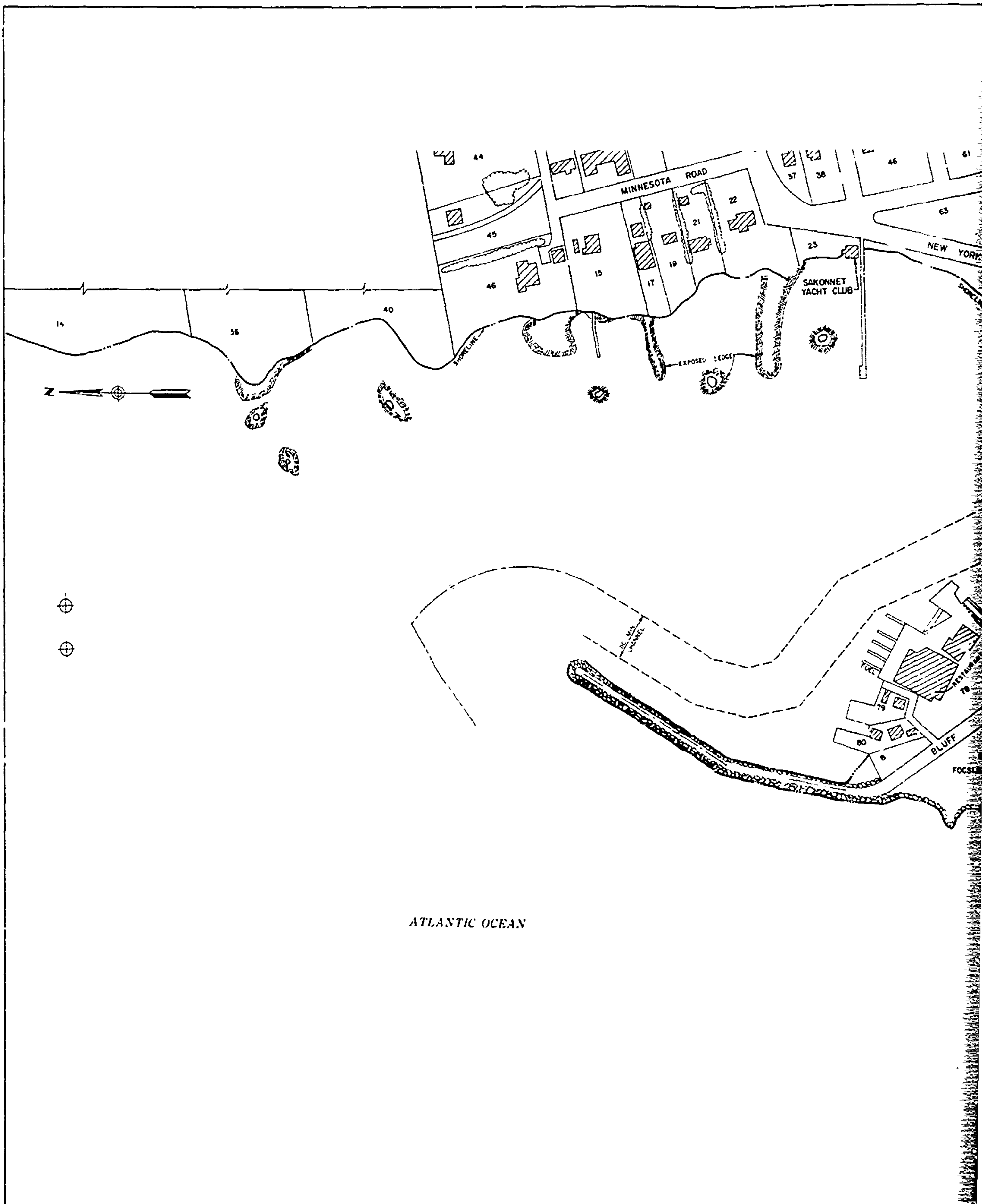
LOCATION: SAKONNET HARBOR, LITTLE COMPTON, R.I.

SIZE PROBE: AW ROD ($1\frac{3}{4}$" O.D.) HAMMER: 140 LBS. FALL: 30-INCHES

PROBE NO.	BOTTOM EL.(M.L.W.)	DEPTH BELOW BOTTOM						TOTAL LENGTH OF PROBE
		1′	2′	3′	4′	5′	6′	
		BLOWS PER FOOT						
C-1	−7.8	4	12	21	32	8/0.2′		4.2′
C-2	−9.3	2	10	21/0.7′				2.7′
C-3	−8.9	34	39	51	5/0.1′			3.1′
C-4	−8.9	19	78	41	4/0.1′			3.1′

NOTES: 1. ALL PROBES DRIVEN TO ELEV. −12.0 (M.L.W.)

FIG. 4-8


MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
FUEL
BLUFF
ATLANTIC OCEAN
14
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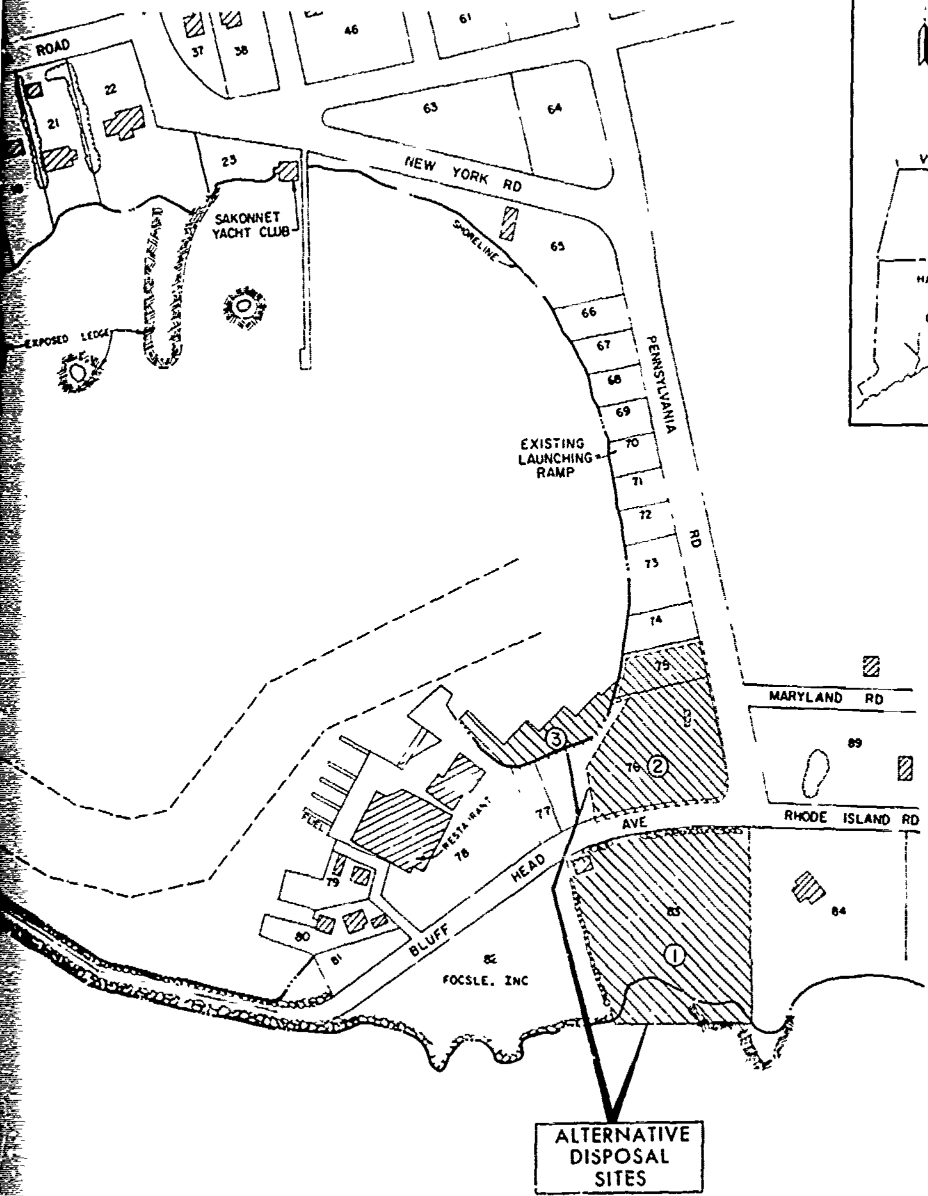
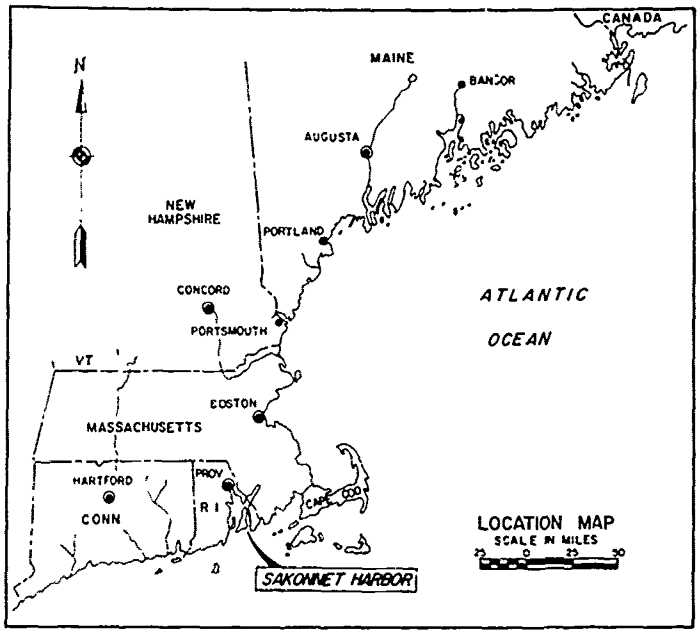




DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MA

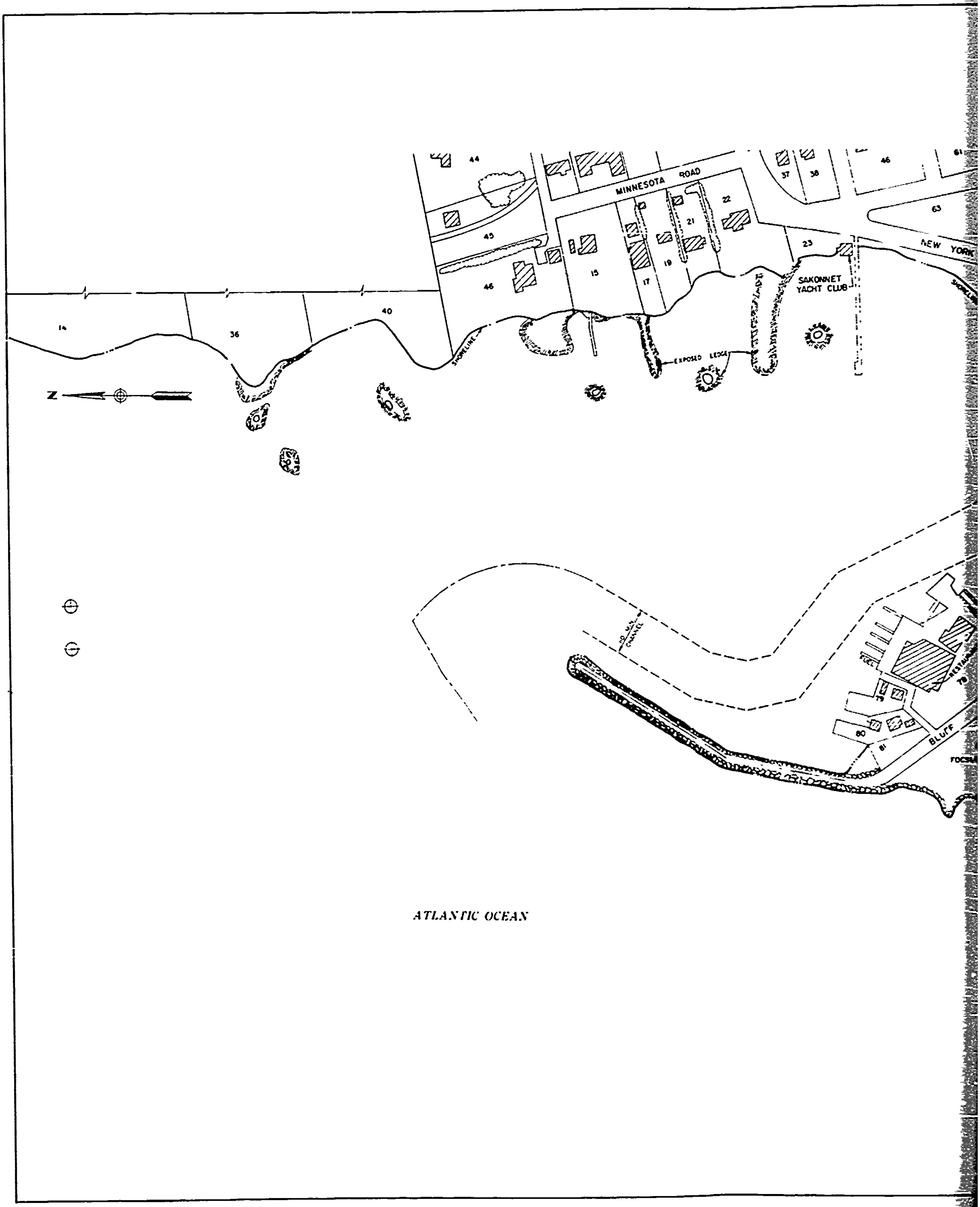
SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

ALTERNATIVE DISPOSAL SITES

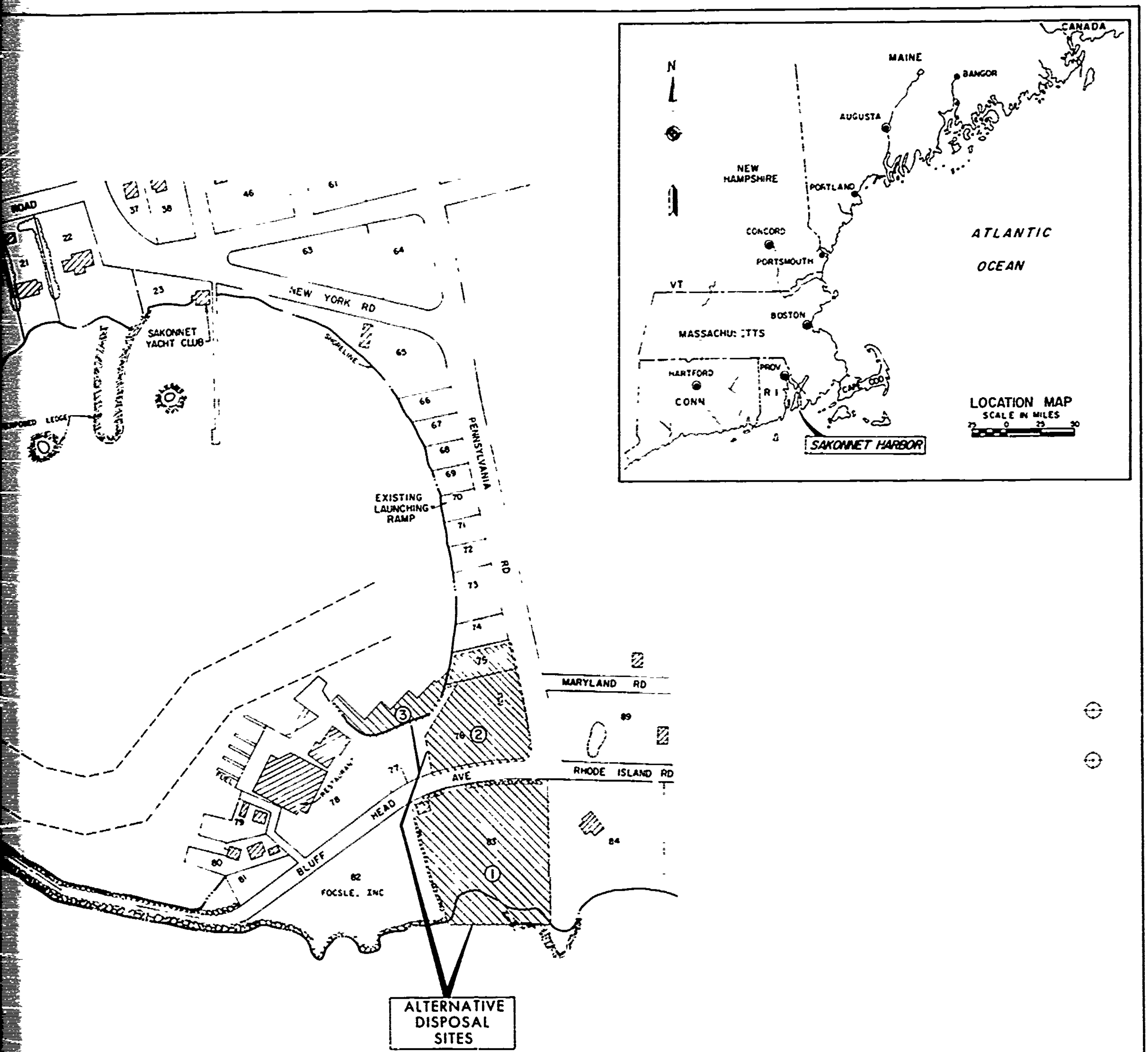
DATE SEPTEMBER 1980 SCALE 1"=100'

FIGURE 4-9

2



MINNESOTA ROAD
NEW YORK
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
FUEL
BLUFF
ATLANTIC OCEAN



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SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

ALTERNATIVE DISPOSAL SITES

DATE SEPTEMBER 1980 SCALE 1"=100'

FIGURE 4.9

SECTION F

HYDROGRAPHIC ANALYSIS AT SAKONNET HARBOR, LITTLE COMPTON, RHODE ISLAND

INTRODUCTION

A detailed hydrographic anlaysis was conducted to determine the impact of a 750 ft. breakwater on Sakonnet Harbor circulation patterns. This analysis included both field and analytical studies. The important conclusions from these studies are:

The water level in Sakonnet Harbor is controlled by a semi-diurnal tide. Long periods of strong northwest winds will depress the mean water level in the harbor.

The observed current field is dominated by the wind in the harbor and a southward regional flow outside the harbor. Field data indicated that a wind-driven two-layer circulation can develop in Sakonnet Harbor.

There is little or no density stratification present in the study area.

A two-dimensional hydrodynamic model was successfully applied to the study area to predict tidal current patterns.

Based upon model predictions, the construction of a breakwater will change the harbor tidal currents. This is not considered significant as wind driven currents are an order of magnitude higher than the tidal currents.

Flow along the inside of the breakwater, which is important for flushing the harbor, is significantly affected by the type of breakwater built. The minimum flow will occur with the longest breakwater. Shortening or reorienting the breakwater will increase the flow by 50% or 85%, respectively.

Estimates of harbor flushing due to winds indicated that steady-state wind velocity of 5 kn down the axis of the harbor will flush the harbor in about 1 day.

The breakwater will limit wave activity but should not directly influence wind circulation patterns.

The wave reflection analysis indicated that with either the long or shortened breakwater the possibility exists that wave reflection will occur. Small waves which could be refracted will impact the north corner of the harbor area. This is the same area which is impacted by wave diffraction. Reorientation of the breakwater will negate any possible wave refraction.

Wave diffraction analysis indicated that waves from the southwest quadrant will impact the northern third of the new anchorage area. This impact is independent of breakwater configuration.

Physical oceanographic investigations and interpretations were conducted to determine whether deleterious effects to Sakonnet Harbor will result from breakwater construction.

These investigations have been limited to predicting the existing conditions and the effects of a breakwater, on the currents within Sakonnet Harbor. Ancillary to this study are wave diffraction impacts and assessment of available water qual data.

METHODS

FIELD STUDIES

Tide elevation data were collected at two locations (Figure 4-10). A General Oceanics film recording tide gauge was mounted on Mooring 1. A resistance tide gauge by Metri Pipe, Inc., installed within a stilling well, was mounted in the Harbor on a piling behind the Fo'c's'le Restaurant.

The General Oceanics tide gauge at Mooring 1 consisted of a Heise pressure gauge and an Accutron watch. Pressure and time were recorded on the film at 7.5 min. intervals. The film was developed for data processing and manually reduced to 15 minute intervals. This data was then transformed to feet measurements by computer, using the relationship between pressure and water depth (1 ft = 2.25 psi). The elevations in feet were averaged over the period of record to determine mean water level (MWL). Tide elevations were plotted as ft. relative to MWL.

The Metri tape tide data were recorded on a Hewlett-Packard Chart Recorder which produced a continuous strip chart of tide data. The strip chart was digitized onto magnetic cassettes and computer processed. The data were normalized relative to mean water level and listed in ft. (MWL).

Near-bottom current velocities were monitored at two locations (Figure 4-10). Mooring 1 was approximately 400 ft. southwest of the existing breakwater in 29 ft. of water. Mooring 2 was approximately 30 ft. northwest of the existing breakwater, within the Harbor, in 13 ft. of water.

A Bendix Model Q-15R, ducted impeller current meter was mounted on a "moonlander" base to obtain current speed and direction measurements 3.3 ft. from the bottom (Figure 4-11). Sensor accuracies were $\pm 12^{\circ}$ for the direction and ± 0.05 kn for speed. The strip chart recorder was accurate to $\pm 2\%$ full scale for both speed and direction.

Current measurements were processed from strip charts by time-basing and digitizing onto magnetic cassette tapes. The data was computer processed and output as a transformed data listing. Vector plots and joint frequency tabulations were also generated. The joing frequency tabulations were used to construct a rose diagram for each mooring.

Currents were profiled at three stations in Sakonnet Harbor and its vicinity on both the flood and ebb tides of March 29 and 30, 1979 (Figure 4-10). Current speed and direction was measured from a double-anchored boat using a Bendix Q-15 current sensor cabled to a Bendix Model 270 recorder on deck. Currents were measured for 3 to 5 minute intervals 3.3 ft. below the surface, approximately 0.6 times depth and 3.3 ft. above the bottom. Each station was visited up to seven times during each tidal stage (ebb or flood). A total of 39 profiles were obtained.

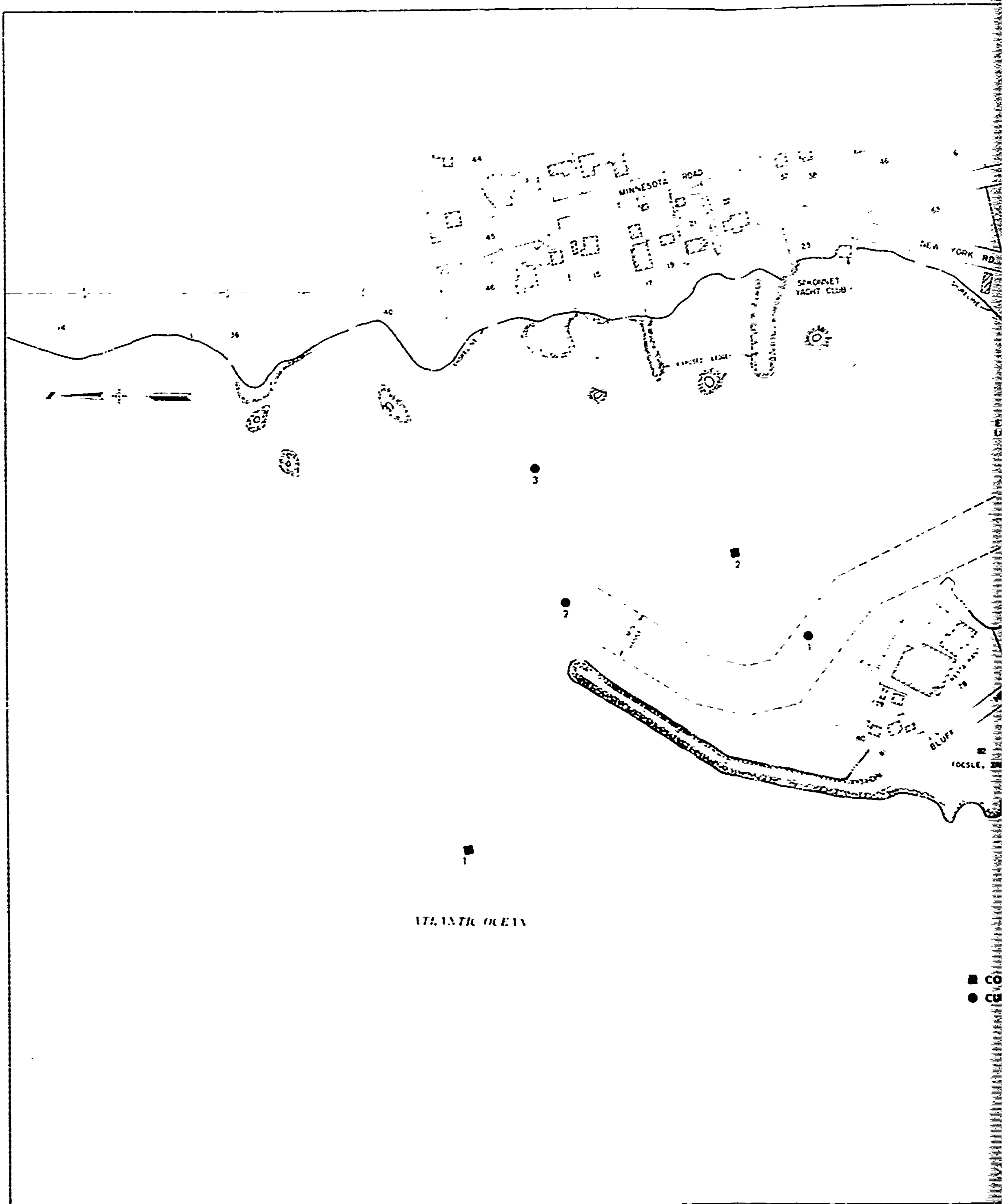
The current meter data was manually reduced from the strip charts and tabulated by depth and time.

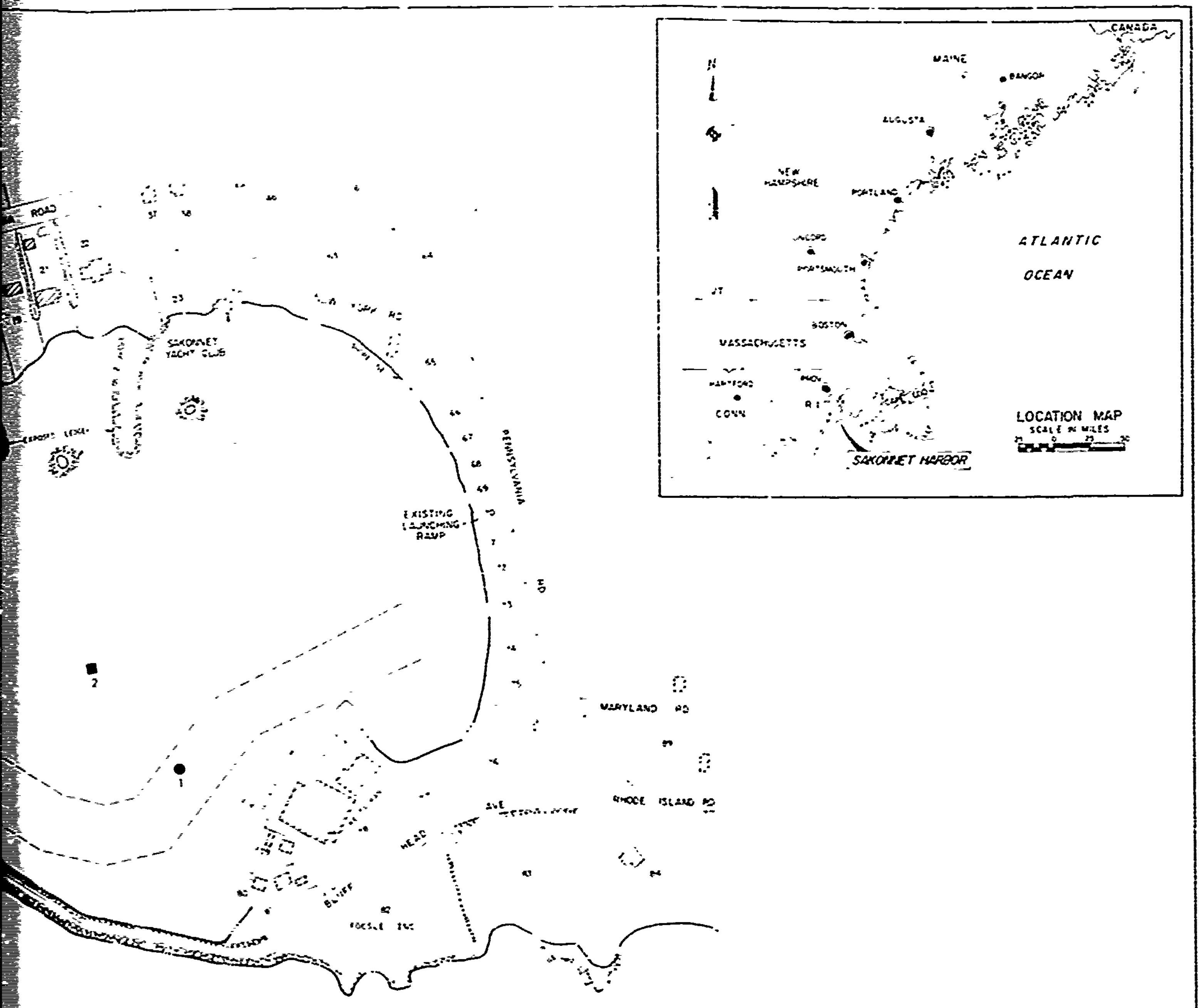
To determine density stratification, temperature and conductivity were measured in conjuntion with the current profile survey. Discrete measurements were made at the surface, 3.3 ft. intervals and 3.3 ft. above the bottom. A Beckman RS5-5 portable salinometer was used for data collection. The conductivity sensor was field calibrated by looping a precision resistor through the instrument head. The field data were converted to salinity and sigma-t using standard conversions.

ANALYTICAL STUDIES

A quantitative hydrographic model was used to obtain more information about tidal current changes related to the construction of a new breakwater. The model predicted currents and tides in the harbor. Predicted values were compared to observed data to demonstrate the validity of the model. It was then used to predict changes in the tidal velocity field, resulting from the longest breakwater construction.

Circulation Analysis by Finite Elements (CAFE) is a two dimensional, vertically averaged, numerical hydrodynamic model developed by Connor and Wang (1973). The model solves a simplified form of the Navier-Stokes and continuity equations using a finite element technique.


MINNESOTA ROAD
NEW YORK RD
SAKONNET YACHT CLUB
BLUFF
ATLANTIC OCEAN



■ CONTINUOUS MONITORING
● CURRENT PROFILING

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SAKONNET HARBOR
LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

CONTINUOUS MONITORING and CURRENT PROFILING LOCATIONS

FIGURE 4-10

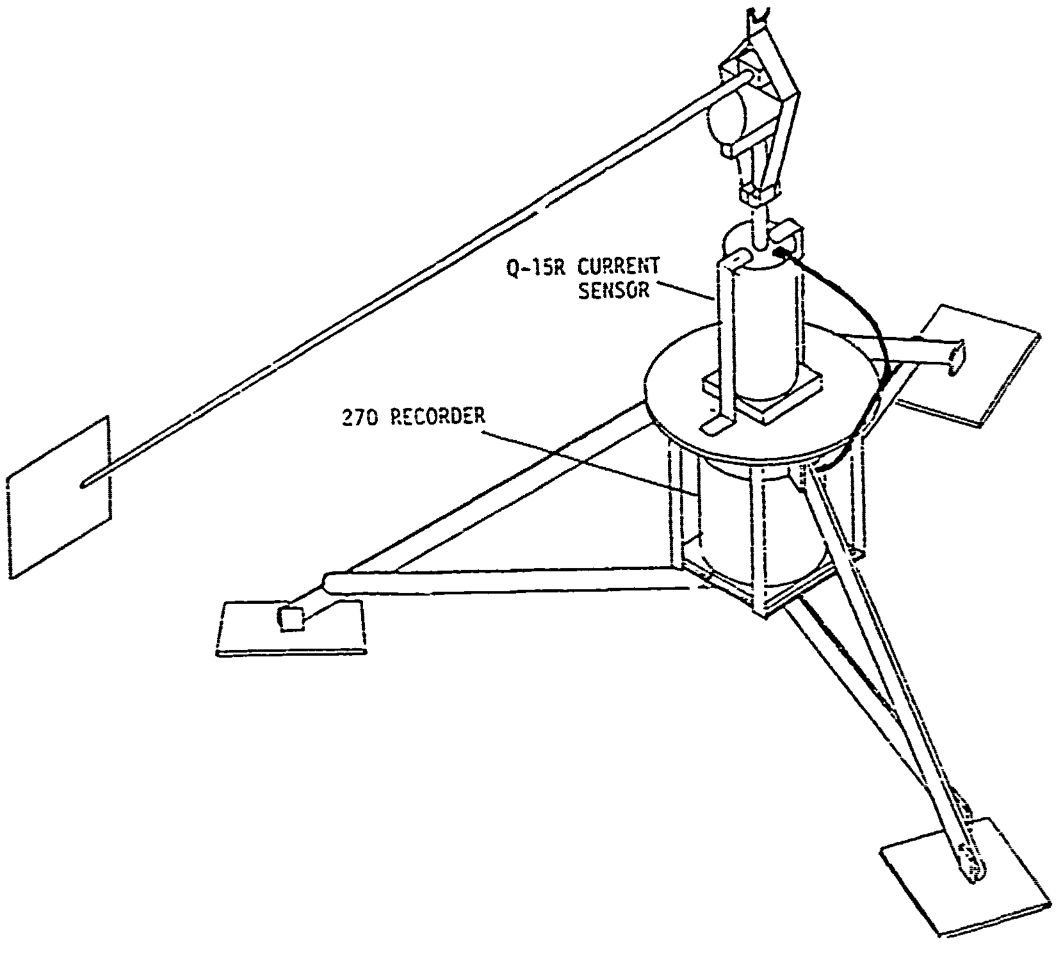


Figure 4-11. In situ instrument platform (moonlander) used for continuous monitoring. Sakonnet Harbor, Rhode Island.

The equations are simplified by assuming incompressible flow, constant density, constant eddy viscosity, and that the second derivative of velocity with respect to perpendicular coordinates is small. Assuming vertical variations of the various parameters are small, the equations are then vertically averaged without loss of meaning. The product of velocity fluctuations (with respect to the vertical average velocity) are internal stresses which, together with horizontal Reynolds stress, are vertically averaged and then approximated by eddy viscosity terms, from vertically averaging the vertical Reynolds shear stress, are approximated by quadratic functions.

Boundary conditions are treated by specifying one component of flow or the surface elevation. Flow normal to the boundary is specified as zero for land boundaries, and set equal to the flow rate at river boundaries. Open or ocean boundaries are treated by specifying surface level elevation. The equations, including the appropriate boundary conditions, are written as variational statements, which serve as the basis for the finite element methods.

The finite element method approximates the solution of a boundary value problem with a function of piece-wise continuous polynomials. This involves discretization of the continuum into an equivalent system of finite elements. Connor and Wang selected the simplest configuration, triangles with nodes at the vertices. The values of the variables within the element are assumed to be a linear function of the values at the nodes. The equations are transformed for application to an element using this linear polynominal representation. Treatment of the entire continuum is accomplished through summation of the contributions of each element. Each nodal value influences all of the elements containing that node, and each element value influences the three nodes of the element. Depth is selected at each node point, while bottom friction and eddy viscosity are selected for each element.

This model is similar to the finite difference model developed by Leendertse (1967). The principal differences are inclusion of the eddy viscosity terms which Leendertse neglects, and the solution technique. Properly formulated, the method of solution should have little effect on the model results. There are, however, advantages and disadvantages to each method. The finite difference method is more easily understood and applied, and has well developed stability criteria. The principal advantage of the finite element method is the flexibility of the grid, making it more appropriate for situations involving complex geometry.

Wave analyses were based on conditions such that waves were generated from a source southwest of the harbor, and propagated shoreward. Observations of their interaction with the harbor mouth during a southwest breeze indicated wave orthogonals[1] approached the harbor form 250°M. The waves were 1 to 2 ft., with a period of 6 sec. Observations by local citizens indicate waves during the summer months usually have orthogonals that parallel the existing breakwater. Waves with periods of 6 to 8 sec. agree with summary data provided in TRIGOM (1974), which condenses wave data from Thompson and Harris (1972) and the U.S. Department of Commerce (1973).

Wave refraction diagrams were constructed for waves with periods of 6 seconds approaching the harbor from two directions. This approximated the summer wave field. The diagrams were constructed using the orthogonal method presented in CERC (1977). This methodology assumes that the change of direction of the orthogonal as it passes over relatively simple hydrography is approximated by Snell's Law:

$$\sin \alpha_2 = \left(\frac{C_2}{C_1}\right) \sin \alpha_1$$

where: α_1 = angle a wave crest makes with the orthogonal as it passes over the bottom contour

α_2 = is a similar angle measured as the wave crest passes over the next bottom contour

C_1 = wave velocity at the depth of the first contour

C_2 = wave velocity at the depth of the next contour

Other assumptions implicit in this method include:

Wave energy between wave rays or orthogonals remains constant.

Direction of wave advance is perpendicular to the wave crest; that is, in the direction of the orthogonals.

Speed of a wave of a given period at a particular locations depends only on the depth at that location.

Changes in bottom topography are gradual.

[1]Orthogonals are lines drawn perpendicular to the wave crests, and extend in the direction of wave advance.

Waves are long-crested, constant-period, small-amplitude and monochromatic.

Effects of currents, winds and reflections from beaches, and underwater topographic variations, are considered negligible.

Wave diffraction in Sakonnet Harbor was analyzed graphically for three cases:

Case 1: Existing harbor configuration with wave orthogonals approaching the jetty at 150°

Case 2: Existing harbor configuration with wave orthogonals parallel to jetty

Case 3: Harbor with 750 foot breakwater and wave orthogonals perpendicular to the gap between the end of the breakwater and the jetty (150°).

These diffraction diagrams were constructed using standard procedures presented in CERC (1977). The basic assumptions inherent in this type of analysis are that water is an ideal fluid, inviscid and incompressible, the waves are of small amplitude and described by linear wave theorty, flow is irrotational and conforms to a potential function which satisfies the Laplace equation, and the depth shoreward of the breakwater is constant.

Estimation of wave reflection was considered based upon techniques described in Weigel (1964), which utilized laboratory data determined by Chen (1961). The results should be prefaced with the observation made by Ippen (1967), that the hydrodynamic processes involved in the interaction of waves with rubble type breakwaters is extremely complex. Two principal assumptions were used (1) the case presented in Weigel is similar to the storm wave case for Sakonnet Harbor and (2) the laboratory studies by Chen (1961) reliably predict the actual situation.

RESULTS

FIELD STUDIES

The General Oceanics tide gauge was mounted on Mooring 1, outside Sakonnet Harbor. The maximum high water at Mooring 1 was 2.7 ft. above MWL. Maximum low water was 2.9 ft. below MW. Mean high and low tides, relative to MWL, were 1.7 ft. and -1.5 ft, respectively. The mean tidal range was 2.4 ft.

Comparison with the NOAA-NOS (1979) Tide Tables indicated the measured tidal range outside the harbor was 0.7 ft. lower than the predicted range. The measured high tides averaged 1.1 ft. lower than the predicted. Low tides averaged 1.3 ft. lower than predicted. Mean observed times of high

and low tides were earlier than the predicted, 1 hr. 6 min. and 1 hr. 16 min., respectively.

The resistance tide gauge was mounted on pilings in Sakonnet Harbor. The maximum high water inside the harbor was 2.7 ft. above MWL. Maximum low water was 2.6 ft. below MWL. Mean high and low tides, relative to MWL, were 1.6 ft. and -1.5 ft., respectively. The mean tidal range was 3.1 ft.

Comparison with the tide tables indicated the measured tidal range was equal to the predicted tidal range, 3.1 ft. The measured high tides averaged 1.3 ft. lower than the predicted. Low tides averaged 1.5 ft. lower than predicted. Mean observed times of high and low tides were earlier than the predicted, 35 min. and 45 min., respectively.

Tide data are shown in Figure 4-12.

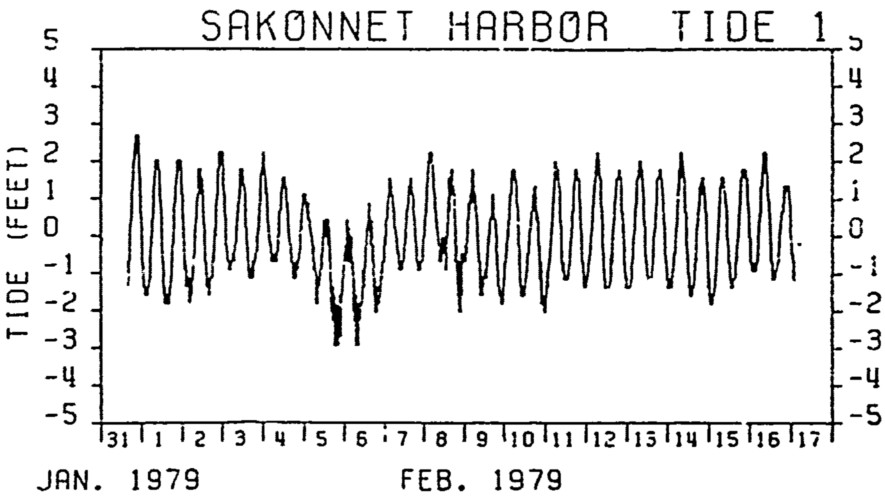
Mooring 1 was outside the existing breakwter in the entrance to the Harbor. Current speed and direction were measured 3.3 ft. above the bottom. Twenty-seven days of data were collected. A summary of the current meter data from Mooring 1 is presented in Figure 4-13.

Current speeds were generally low. Seventy-eight percent of the speeds were below threshold (0.06 kn). The predominant directions of flow were south to southwest (180^{o}-225^{o}), with a mean speed of 0.07 kn. Highest mean speeds were associated with northwest to west-north-westerly flows, and averaged 0.17 kn (14.9 cm/sec). The highest speed recorded during the sampling period was 0.29 kn (14.9 cm/sec), from the southwest (224^{o}). Rose diagrams of the current meter data are shown in Figure 4-14.

Mooring 2 was within the main channel of Sakonnet Harbor. Current speed and direction was measured 3.3 ft. above the bottom. Twenty days of data were collected at this mooring. These current data are summarized in Figure 4-15.

Current speeds were low within the harbor. Seventy-two percent of the readings were below threshold (0.06 kn). The predominant directio of flow was northwest to north (315^{o}-0^{o}). Highest mean speeds were from the east-northeast, 0.07 kn (3.6 cm/sec), and the northeast, 0.10 kn (5.1 cm/sec). The highest speed measured at Mooring 2 was 0.24 kn (12.3 cm/sec), from the northeast (48^{o}).

Current profiling studies were conducted at three stations during an ebb tide and a flood tide. The results of the current speed survey are presented in Table 4-4.



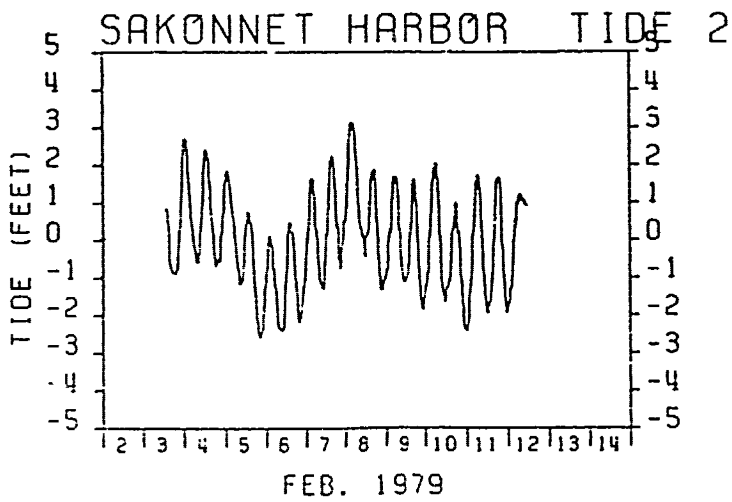


Figure 4-12. Tide data Tide Site 1 was Mooring 1 outside harbor and Tide Site 2 was located near Fo'c's'le Restaurant. Sakonnet Harbor, Rhode Island.

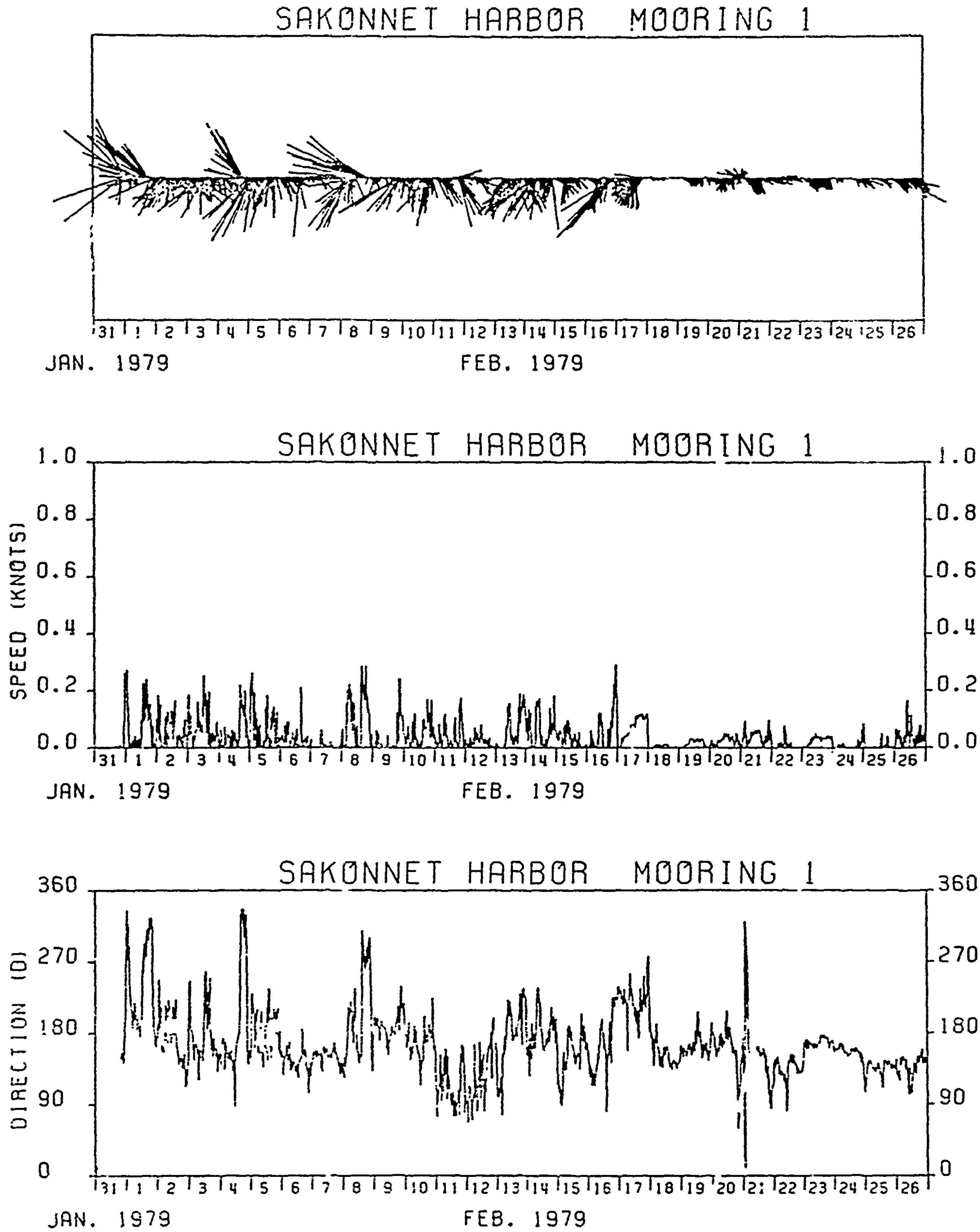
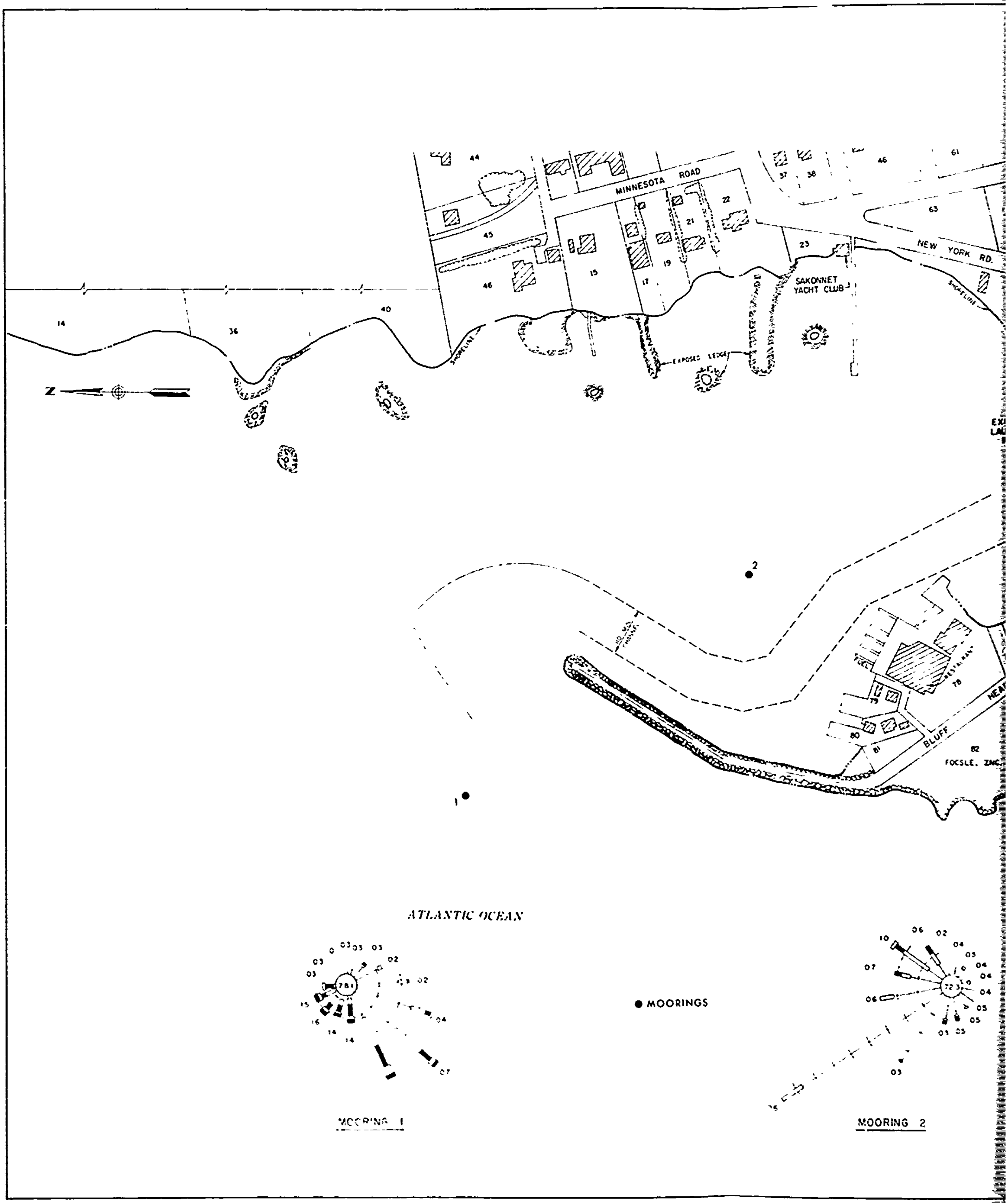
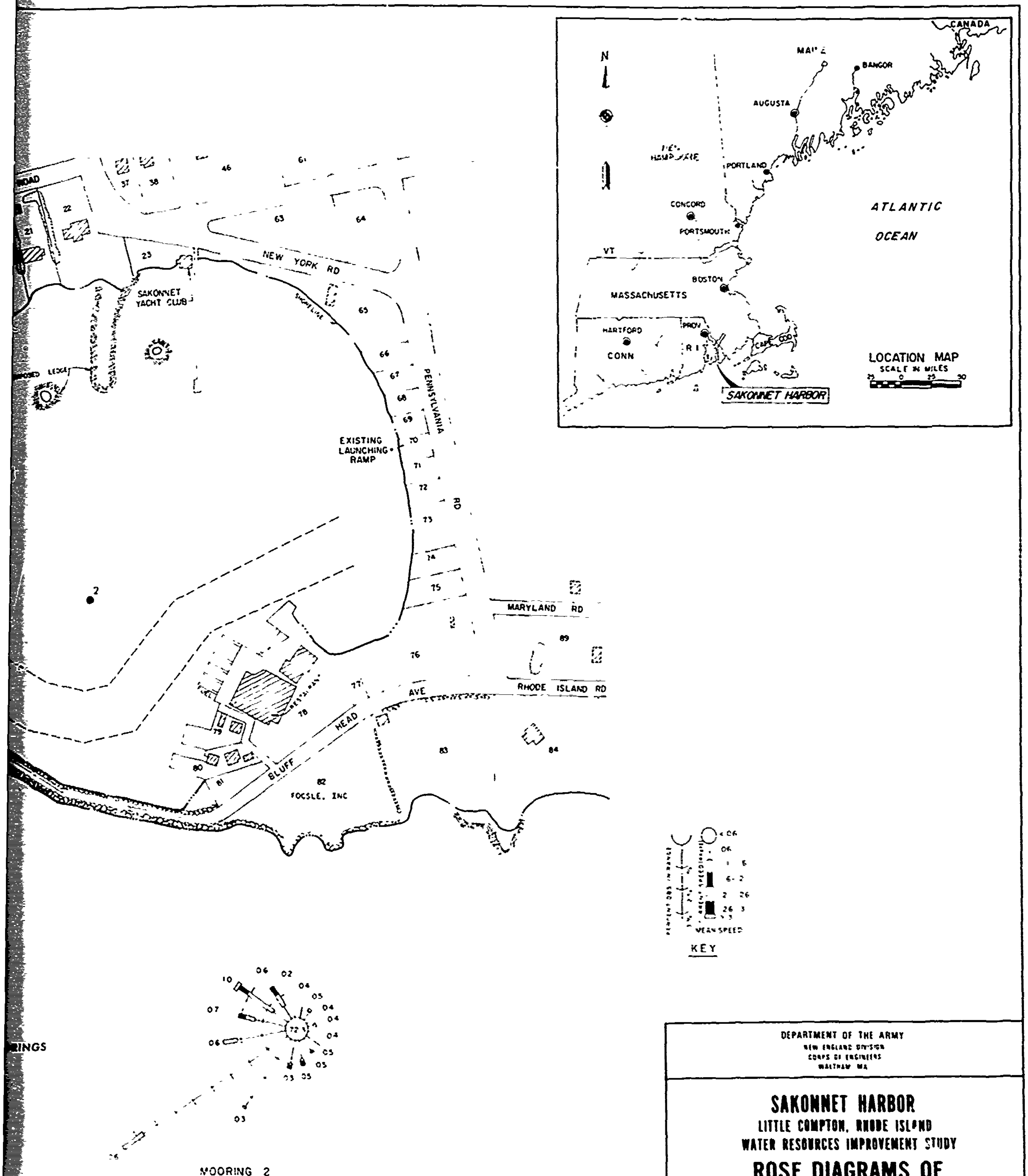


Figure 4-13. Summary of current meter data from Mooring 1. Sakonnet Harbor, Rhode Island.



MINNESOTA ROAD
NEW YORK RD.
SAKONNET YACHT CLUB
EXPOSED LEDGE
SHORELINE
BLUFF
FOCSLE, INC.
ATLANTIC OCEAN
MOORINGS
MOORING 1
MOORING 2



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MA

SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND
WATER RESOURCES IMPROVEMENT STUDY

ROSE DIAGRAMS OF CURRENT METER DATA

DATE SEPTEMBER 198_ SCALE 1" =100'

FIGURE 4-14

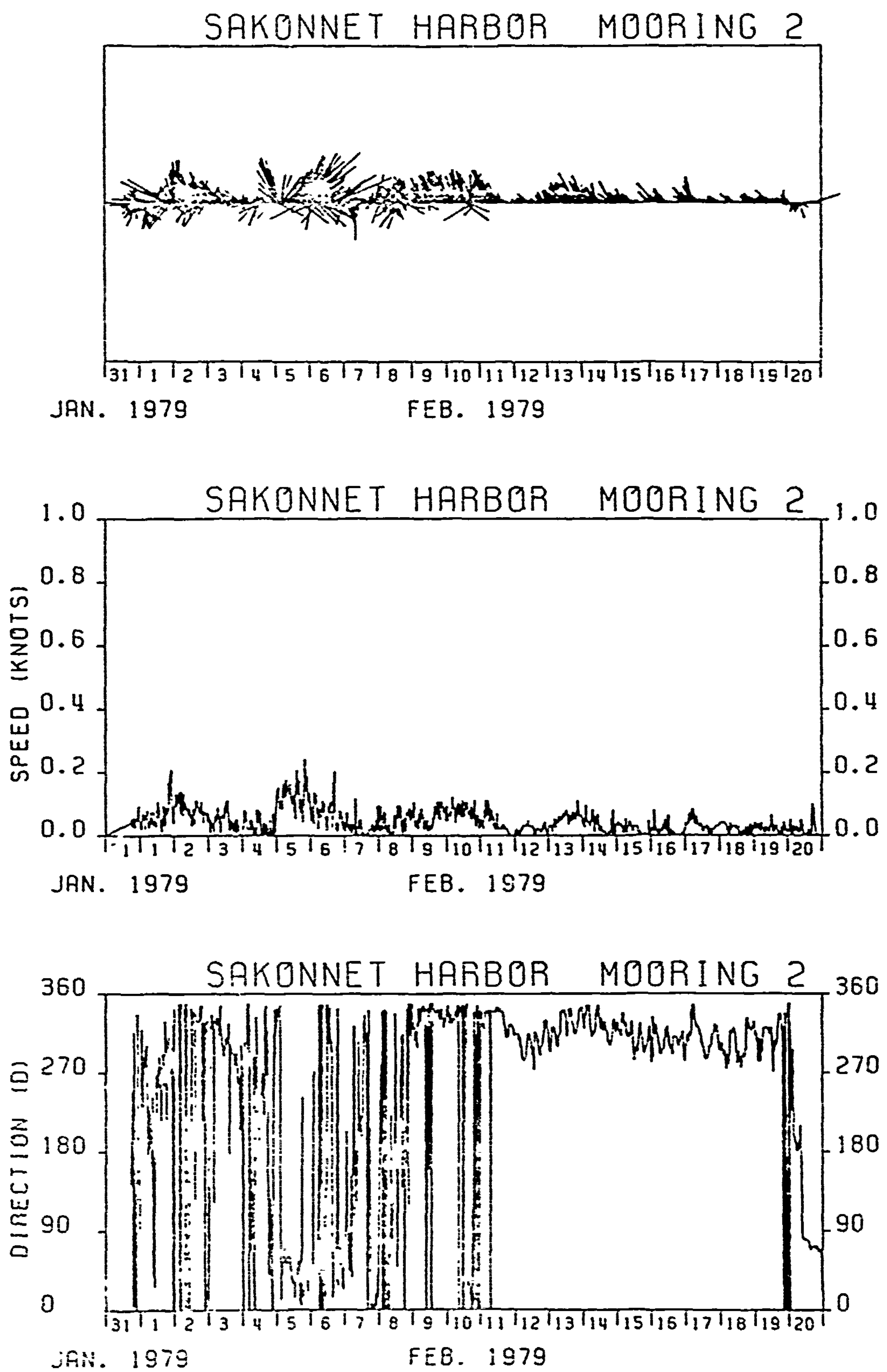


Figure 4-15. Summary of current meter data from Mooring 2. Sakonnet Harbor, Rhode Island.

TABLE 4-4. CURRENT SPEEDS MEASURED FROM SURFACE TO BOTTOM DURING PROFILE SURVEY SAKONNET HARBOR, RHODE ISLAND

STATION		EBB (kn) MEAN SPEED	FLOOD (kn) MEAN SPEED	SPEED (kn) BETWEEN TIDES
1	Surface	0.08*	0.05	-0.03
	Bottom (6.6 ft)	0.07	0.08	+0.01
speed (kn) Surface to Bottom		-.01	+0.03	
2	Surface	0.13	0.08	-0.05
	Bottom (9.9 ft)	0.15	0.04	-0.11
speed (kn) Surface to bottom		+0.02	-0.04	
3	Surface	0.09	0.06	-0.03
	Bottom (9.9 ft)	0.12	0.05	-0.07
speed (kn) Surface to bottom		+0.03	-0.01	

(*NOTE: 1 kn = 51.4 cm/sec)

At Station 1, surface speeds were slightly higher than bottom speeds during ebb tide, and reversed, with bottom speeds higher during the flood tide. At Station 2, ebb tide showed stronger flows on the bottom than at the surface. Flood tide brought higher surface flows than bottom flows at this station. Station 3 was similar to Station 2, with higher bottom flows at the ebb and higher surface flows on the flood. The maximum difference in current speed on the ebb from surface to botton was 0.04 kn and the mean speed from surface to bottom on the flood was 0.02 kn for the three stations.

Measurements of temperature and conductivity were taken during the current profile survey. Salinity values were derived from these data and sigma-t (σ_t) was computed.

Sigma-t values increased from the surface to the bottom at all three stations. The difference between surface and bottom values averaged 0.18 sigma-t units. Very little density stratification of the water column was indicated. These data are shown on Table 4-5.

TABLE 4-5. AVERAGE SIGMA-t (σ_t) MEASUREMENTS FROM TEMPERATURE AND SALINITY DATA GATHERED DURING THE CURRENT PROFILE SURVEY, SAKONNET HARBOR, RHODE ISLAND.

STATION 1		
DEPTH (m)	EBB	FLOOD
0.0	26.73	26.99
1.0	27.34	27.11
2.0	27.50	27.21

STATION 2		
DEPTH (m)	EBB	FLOOD
0.0	27.13	27.19
1.0	27.39	27.23
2.0	27.48	27.32
4.0	27.73	27.46
6.0	27.62	27.29

STATION 3		
DEPTH (m)	EBB	FLOOD
0.0	27.13	27.19
1.0	27.36	27.21
2.0	27.61	27.35
4.0	27.62	27.42

ANALYTICAL STUDIES

The hydrodynamic model was calibrated by processing the tidal phase and tidal range data from the NOAA-NOS (1979) tide tables into the model as predetermined northern and southern boundaries. The model was run on the computer and model-predicted currents in and around Sakonnet Harbor were compared with the field data collected outside Sakonnet Harbor. The model was calibrated so that the predicted and observed current speeds were similar. This calibration allowed the model to predict realistic tidal currents that could be used in the breakwater analysis.

The field studies, which measured current speed and direction, and tidal height, and the analytical study to estimate the tidal prism inside Sakonnet Harbor were used to validate the model.

Water elevation changes over the tidal cycle, as predicted by the model, compare favorably with the observed tides (Figure 4-16). The maximum range of the differences between the predicted tide and the observed tide was 0.6 ft. (0.18 m).

The comparison of observed current speeds with model-predicted speeds was poor. The model predicted tidal current speeds which were about an order of magnitude smaller than observed speeds. The continuous current velocity data exhibit little tidal variation. The best example of tidal influence on the velocity can be seen from February 12 to 19, 1979 current data. During that time, current speeds were approximately 0.04 kn (2.5 cm/sec), which was slightly higher than the predicted tidal current speeds. The model-predicted speeds and observed speeds do not compare favorably because, in most cases, wind plays a role in increasing the local current speeds.

Because the observed speeds did not compare favorably with predicted speeds, the model data were analyzed to determine the predicted tidal prism. This volume was compared with an independently calculated tidal prism.

The model predicted a tidal prism of $70 \times 10^3 m^3$ which compares favorably to the tidal prism of $80 \times 10^3 m^3$ calculated by digitizing the comparable harbor area and multiplying by the observed average tidal range. By determining the cross-sectional area through which this volume must pass during a flood or an ebb tide, an average tidal current of 0.01 kn (0.4 cm/sec) was calculated. This again compares favorably with the average tidal currents predicted by the model.

The three-dimensional movements of water in an estuary or harbor are governed by the Navier-Stokes and continuity equations. When the equations governing a system are known, it is generally assumed that the response of the system can be accurately modeled. This is not the case with estuaries and harbors, as the equations are non-linear, and represent both deterministic and stochastic processes, which range in scale from

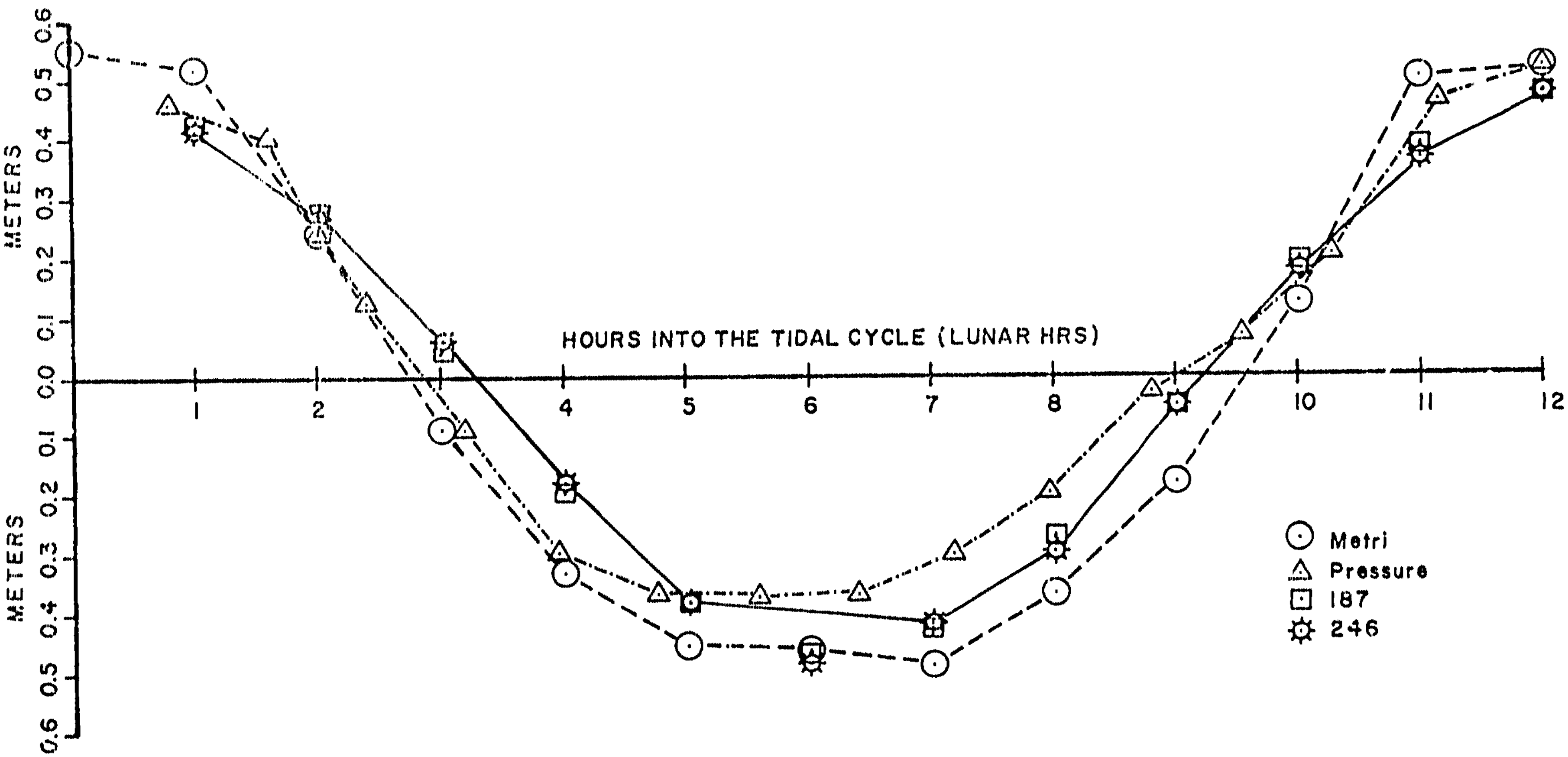


Figure 4-16. Comparison of field measured and model predicted tidal heights. Sakonnet Harbor, Rhode Island.

fractions of a centimeter per second, to hundreds of kilometers and weeks or months. In addition, the forcing functions and boundary conditions are complex and not easily measured. As a result, the equations are simplified to various forms, which are used to study specific processes. The two-dimensional vertically averaged model presented in this report has been developed to predict the horizontal variation in the mean flow, and works well for shallow tidal basins with little or no stratification. However, the model yields no information on the vertical velocity profile.

The typical approach to the vertical velocity profile is to relate the vertical Reynolds shear stress, using a mixing length model, to the vertical gradient of the horizontal velocity. This model is called an eddy viscosity model, and the coefficient of equality, called the eddy viscosity coefficient, is a product of a mixing velocity and length.

Ekman (1905) first used this type of model to investigate wind induced flow. In this work, the Navier-Stokes equations are simplified to a balance between the Coriolis term, and the vertical gradient of the vertical Reynolds shear stress:

$$fu = \frac{1}{\rho}\frac{\partial}{\partial z}(\tau_{yz}) = N_z \frac{\partial^2 v}{\partial z^2}$$

$$-fv = \frac{1}{\rho}\frac{\partial}{\partial z}(\tau_{xz}) = N_z \frac{\partial^2 u}{\partial z^2}$$

The surface boundary conditions are no surface stress in the x direction

$$\rho N_z \frac{\partial u}{\partial z}\Big|_{z=0} = 0$$

and the surface stress in the y-direction is the wind stress

$$\tau_{sy} = -\rho N_z \frac{\partial v}{\partial z}\Big|_{z=0}$$

The bottom boundary condition is that of no velocity as the depth goes to infinity

$$u = v = 0 \Big|_{z=\infty}$$

The resulting profile has a velocity which decreases exponentially with depth, and the surface current direction is 45° to the right of the wind stress and the angle increases with depth. Changing the bottom boundary condition to a finite depth causes the magnitude of the current and deflection angle to decrease.

Similar, but more sophisticated models have recently been developed by many investigators which include aspects such as unsteady wind effects, density gradients, lateral boundaries, variable bathymetry, and depth varying eddy viscosity coefficient (e.g., Neumann, 1968; Heaps, 1972, 1974; Forristall, 1974; Leendertse, 1975; Thomas, 1975; Koustites, 1976; Cooper and Pearce, 1977; Madsen, 1977).

Unfortunately, the ability to make appropriate field measurements for evaluation, application and validation of these models has not developed as rapidly. Oil spill research has prompted study of surface currents, and in particular those produced by wind. The results of these field experiments indicate that the speed of the wind driven current is between 0 and 6 percent of the wind velocity, and the direction ranges from slightly to the left of wind direction to as much as 15^{o} to the right (Stolzenbach, 1977). As a result, for the purposes of modeling oil spill movements, the 3% rule is widely used. This rule of thumb states that the surface current speed is 3% of the wind speed, and is in the same direction.

Therefore, although there are several sophisticated models which may be employed in the scientific study of these processes, the effort and cost of correspondingly sophisticated field data limits the usefulness of these models for making predictions. In the case of Sakonnet Harbor, the simpler model applied here is adequate for producing predictions for the purposes required.

Wave diffraction patterns were constructed for the Harbor without the proposed breakwater (Attachments 4-A and 4-B). Results of these calculations indicated that wave height rapidly attenuates within the Harbor. Therefore, diffracted waves with heights greater than 0.2 the incident wave height will not be observed in the existing anchorage.

A gap diffraction analysis was conducted to estimate the diffraction pattern of the 750-foot breakwater. The resulting pattern showed the heights of diffracted waves will be greater than the incident wave height just inside the inlet (Attachment 4-C). This results from the reinforcing nature of waves diffracting around both breakwaters.

Wave refraction diagrams were constructed for a characteristic wave with height of 3 ft., period of 6 sec. and the wave orthogonal parallel to the existing breakwater. Similar diagrams were constructed with the same wave height and period as the wave diffraction, but with the orthogonal parallel to the 750-foot breakwater. The bottom topography is relatively smooth and nearly parallel to either wave orthogonal, therefore little wave refraction will occur (Attachments 4-A and 4-B).

Investigation of wave reflection resulting from the 750-foot breakwater indicated that significant wave reflection will not occur. Because the knowledge of reflection from solitary waves approaching a slope at other

than normal incidences is limited (Wiegel, 1964). the investigation of wave reflection/potential wave reflection impacts are considered only in the Discussion Section.

DISCUSSION

INFLUENCE OF A BREAKWATER ON CURRENT PATTERNS

The rise and fall of the water level in Sakonnet Harbor produces tidal currents. These tidal currents are very weak, as predicted by the model (Figures 4-17 through 4-20). The general circulation pattern within the area can be summarized as follows:

Ebb tide

Water outside the Harbor in the Sakonnet River moves southward at about 2-3 cm/sec. Water within the Harbor moves northward out of the Harbor. The strongest flows, 0.5 to 1.5 cm/sec are predicted for the center of the Harbor, and at the end of the existing breakwater as Harbor water is entrained with Sakonnet River water (Figure 4-17).

Low Slack Tide

At low slack tide in the Harbor, Sakonnet River water still moves southward due to the phase difference in the tides (Figure 4-18).

Flood Tide

Water movement into the Harbor occurs while Sakonnet River water is moving northward. Flood current speeds are similar to those observed on the ebb, with strongest flows in the center of the Harbor and at the end of the existing breakwater (Figure 4-19).

High Slack Tide

At high slack in Sakonnet Harbor, the Sakonnet River water is still flooding northward (Figure 4-20).

Effects of Breakwater

The change in current resulting from various breakwater configurations was determined through comparison of circulation patterns and current speeds. Tidal circulation patterns at the four critical tide stages are shown on Figures 4-17 through 4-20.

During mid-ebb tide, the shortened and reoriented breakwaters caused increased speeds inside the new breakwater. The 750-foot breakwater caused eddies to develop along the eastern and western shores of the Harbor.

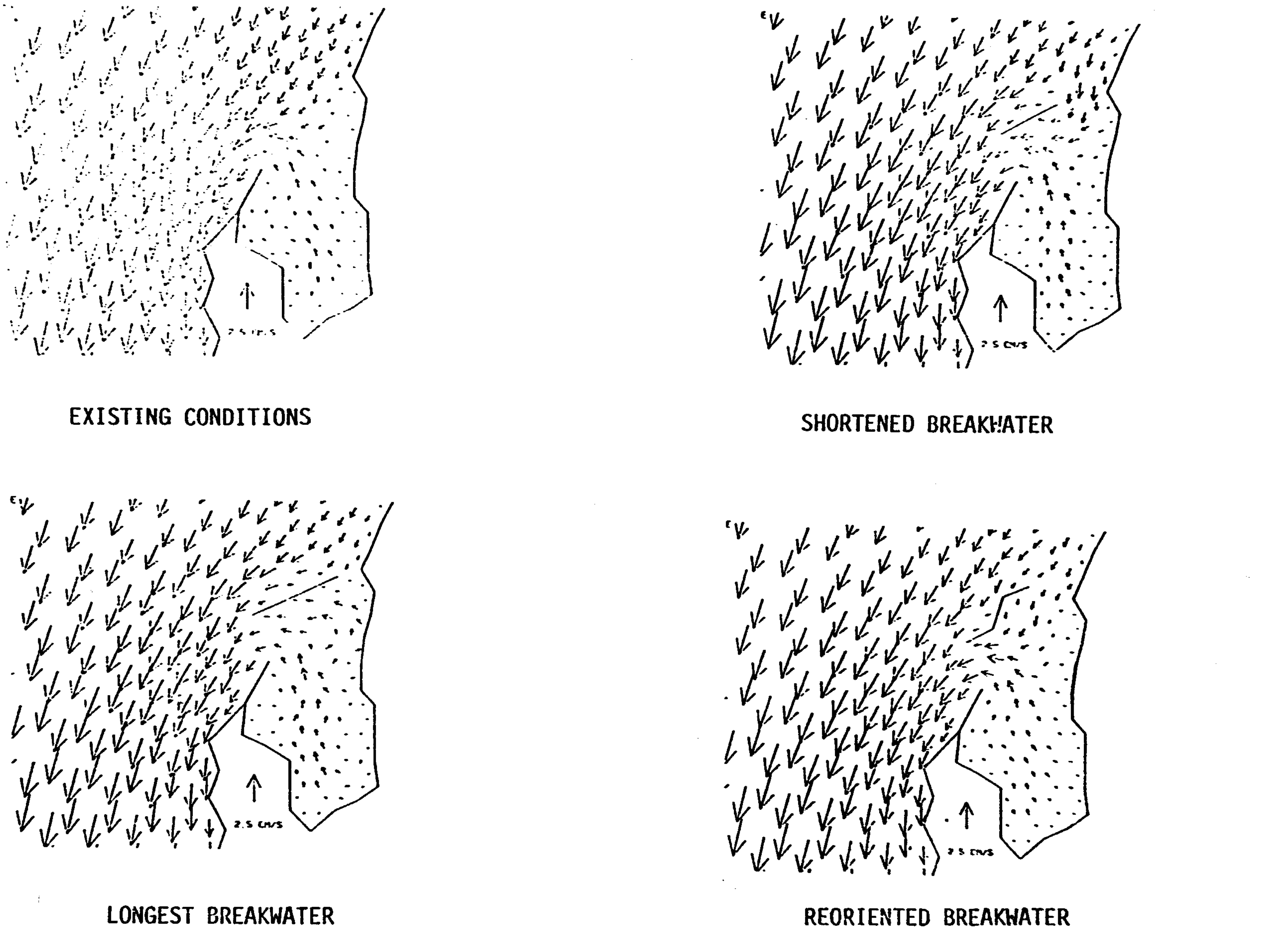
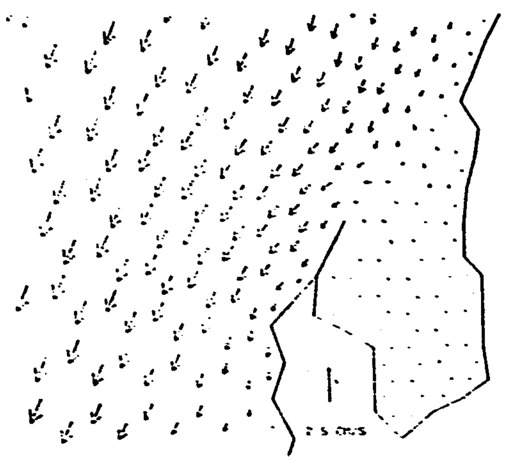
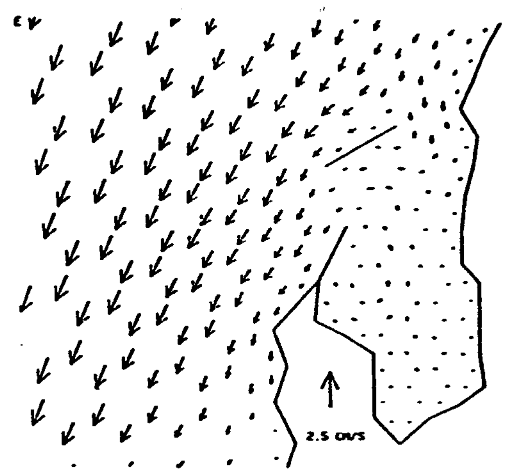


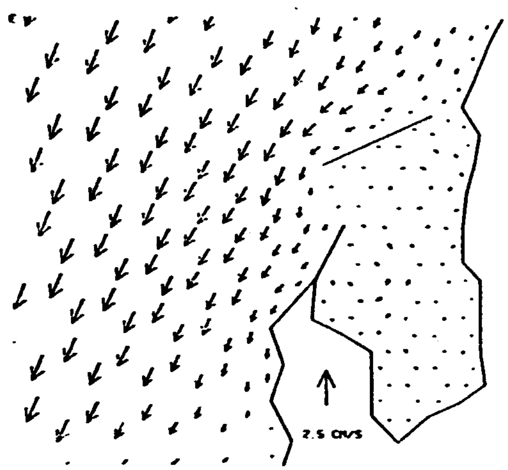
Figure 4-17. Mid ebb current speeds as predicted by the hydrodynamic model. Sakonnet Harbor, Rhode Island.



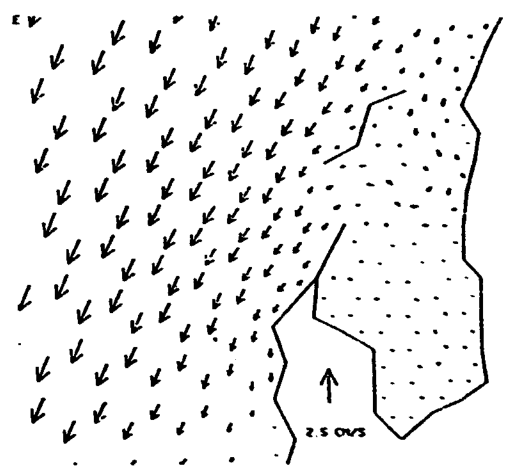
EXISTING CONDITIONS



SHORTENED BREAKWATER



LONGEST BREAKWATER



REORIENTED BREAKWATER

Figure 4-18. Low water current speeds as predicted by the hydrodynamic model. Sakonnet Harbor, Rhode Island.

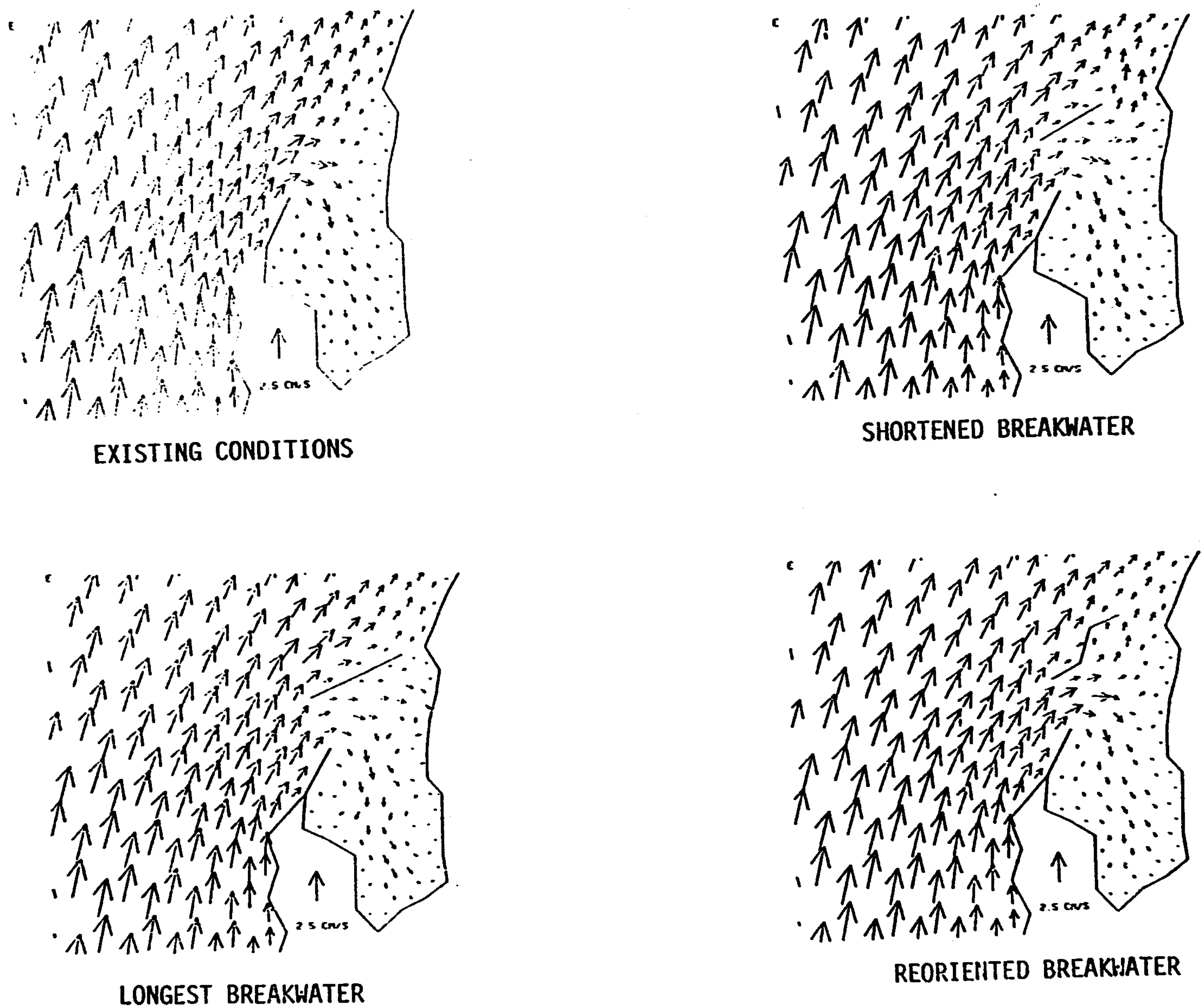


Figure 4-19. Mid flood current speeds as predicted by the hydrodynamic model. Sakonnet Harbor, Rhode Island.

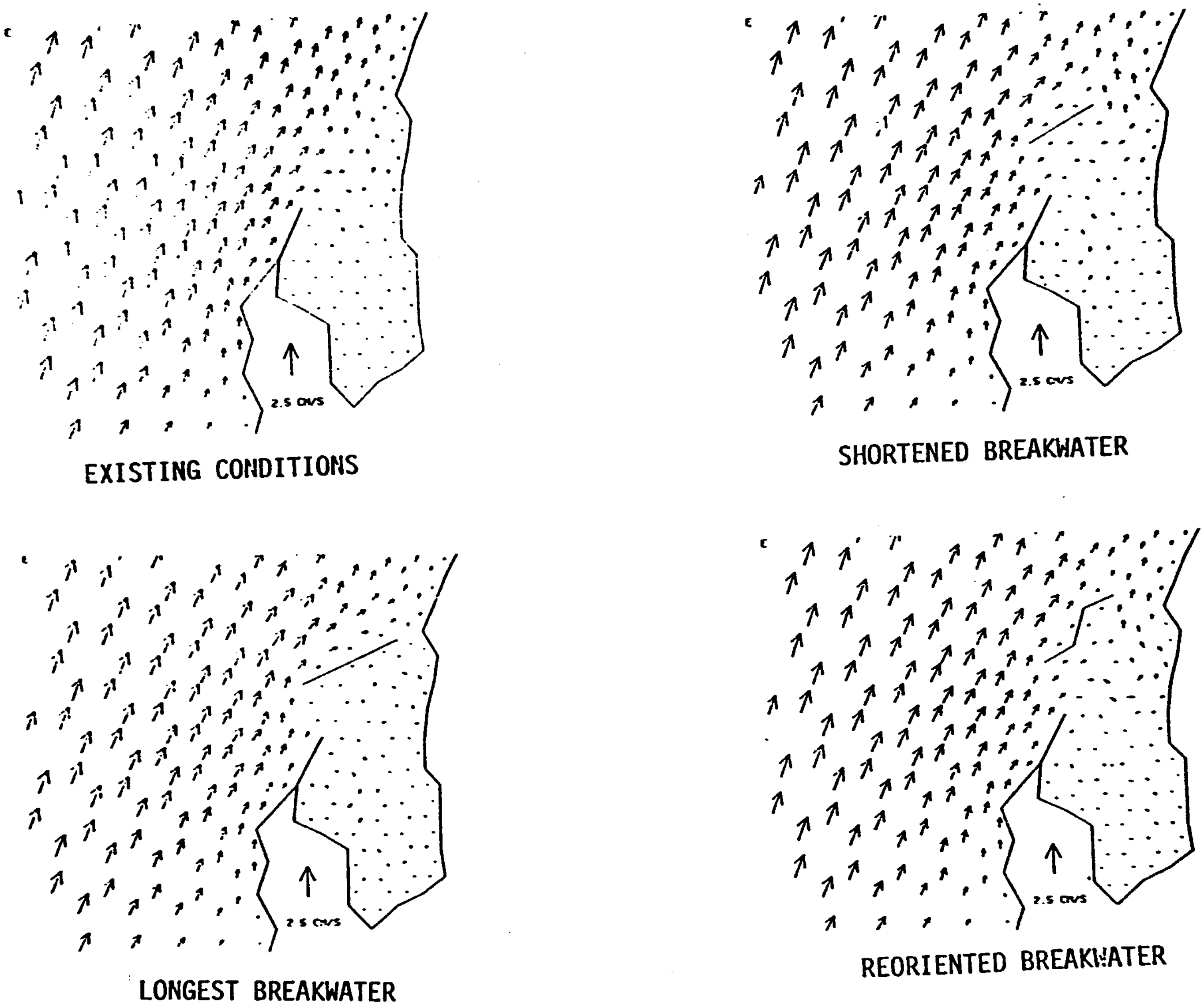


Figure 4-20. High water current speeds as predicted by the hydrodynamic model. Sakonnet Harbor, Rhode Island.

At low slack water, there was no obvious current in the Harbor associated with the 750-foot breakwater configuration. This is similar to present conditions. The shortened and reoriented breakwaters allow southward flow during low slack water.

During mid-flood tide, the shortened and reoriented breakwaters caused northward flow on the inside of the breakwater and out of the Harbor. The 750-foot breakwater caused eddies to develop in the Harbor during mid-flood.

At high slack water, there was no northward flow along the shortened and reoriented breakwaters. There was no current throughout the Harbor with the 750-foot breakwater.

The changes in current speed were analyzed more quantitatively for each of the following cases:

- Predicted circulation changes with the 750-foot breakwater, relative to presently existing condition (i.e., no new breakwater)

- Predicted circulation changes with shortened breakwater, relative to existing condition

- Predicted circulation changes with reoriented breakwater, relative to existing condition

- Predicted circulation changes with shortened breakwater, relative to 750-foot breakwater

- Predicted circulation changes with reoriented breakwater, relative to 750-foot breakwater

- Predicted circulation changes with reoriented breakwater, relative to shortened breakwater.

The average current speeds at each node within the limit of the study area were used in this analysis. The difference in average at each node for each case was computed and plotted. Figure 4-21 shows the areas of increased or decreased current speed.

Case 1, where the 750-foot breakwater is compared to existing conditions, the breakwater will generally increase existing tidal current speeds throughout the Harbor. The exception to this was in areas along the western shore, off the breakwater, and in a small area in the center of the Harbor.

Case 2, where the shortened breakwater is compared to existing conditions, the areas of decreased average current speeds are similar to Case 1. However, decreased average current speeds are more widespread along the western and eastern shores.

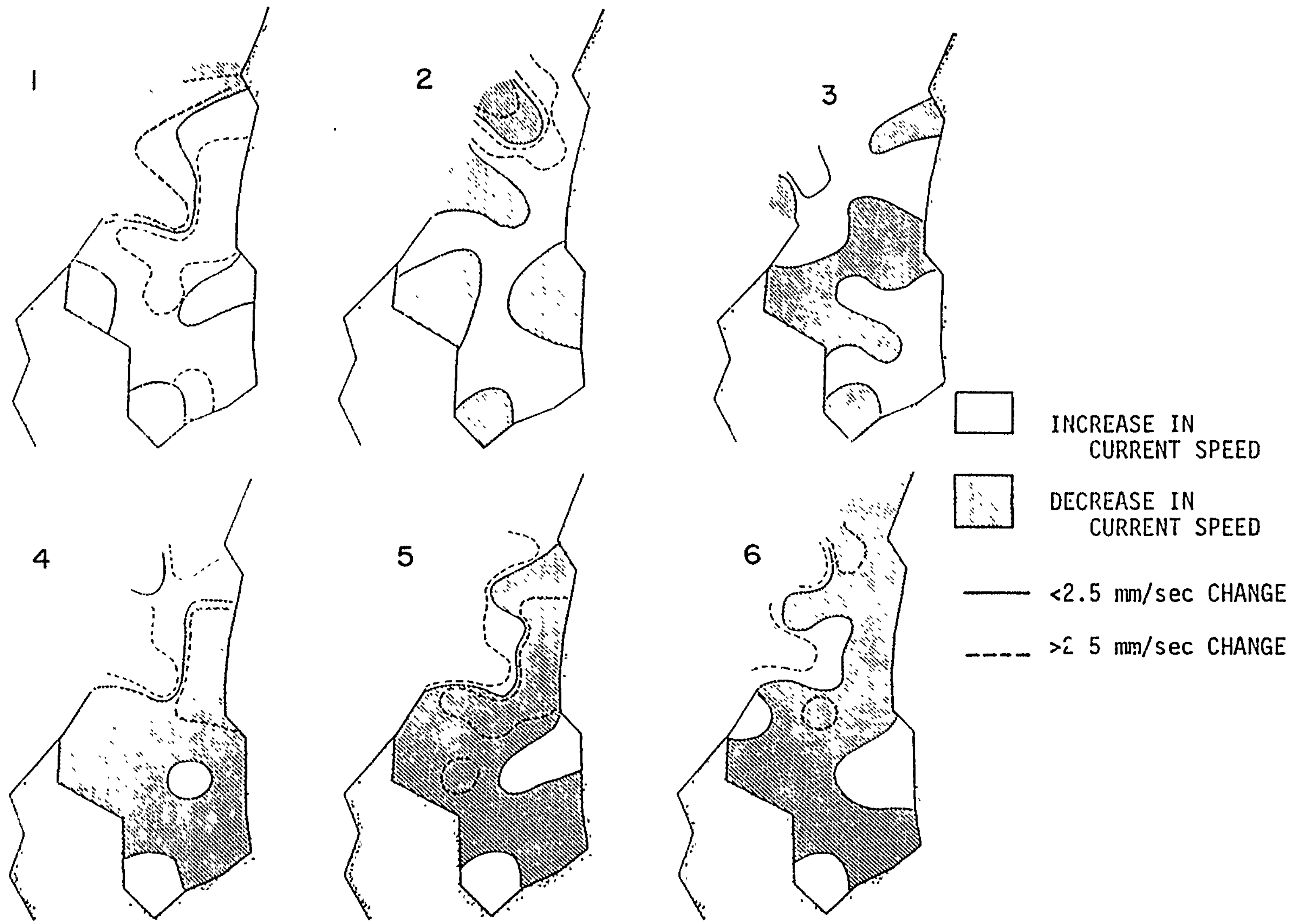


Figure 4-21. Predicted changes in current speed in Sakonnet Harbor, Rhode Island, with various breakwater configurations compared either to existing conditions (no new breakwater) or to other breakwater configurations. See text for explanations of the six illustrated cases. Hachured areas represent areas of reduced current speed, white areas represent increased current speed. Solid and dashed lines represent isopleths at 2.5 mm/sec increments.

In Case 3, the reoriented breakwater causes the greatest area of decreased average tidal current speeds.

In Cases 4 and 5, the shortened and reoriented breakwaters decrease current speeds in the inner harbor area relative to those speeds associated with the 750-foot breakwater. Increased speeds occur in the vicinity of the breakwater.

Finally, in Case 6, the reoriented breakwater produces decreased currents relative to those associated with the shortened breakwater. The exception to this is along the eastern shore, where speeds are generally higher.

It is important to stress that although the breakwaters may decrease tidal components of currents in particular areas of the harbor, the really significant flow is that generated by winds. Maximum current speeds on an ebb and a flood tide through the west inlet were estimated using the tidal currents generated by the hydrodynamic model and the surface wind currents estimated by the model (Table 4-6). The wind is much more a controlling factor than are changes in breakwater configuration; with a 5 kn (257 cm/sec) wind, the various types of breakwaters will cause only a 5% variance in current speeds (Table 4-6).

TABLE 4-6. MAXIMUM PREDICTED SURFACE CURRENTS IN WEST INLET. CURRENT PROFILE SURVEY, SAKONNET HARBOR, RHODE ISLAND

WIND CONDITION	CURRENT SPEED (cm/sec) BREAKWATER CONFIGURATION			
	A	B	C	D
Southwest wind during maximum flood tide				
257 (5 kn)	9.8*	9.3	10.3	9.8
514 (10 kn)	17.4	17.0	18.0	17.4
771 (15 kn)	25.3	24.8	25.8	25.3
1,028 (20 kn)	33.0	32.5	33.5	33.0
Northeast wind during maximum ebb tide				
257 (5 kn)	9.7	8.1	10.3	9.7
514 (10 kn)	17.4	16.8	18.0	17.4
771 (15 kn)	25.2	24.6	25.8	25.2
1,028 (20 kn)	32.9	32.3	33.5	32.9

*1 kn = 51.4 cm/sec

The effect of the breakwater construction on mass flux was evaluted. Flow across three transects was computed using the data from the hydrodynamic model. These transects were (1) across the Harbor entrance, (2) the west passage when a breakwater is present, and (3) the north inlet between a breakwater and the shore. Due to limitations in the computational methodology, these are estimates of mass flux only (Figure 4-22).

For the Harbor under existing conditions, the model predicted a tidal prism of approximately 60 to 70,000 m^3 of water which passes the Harbor transect. This volume will not change as a result of breakwater construction (Table 4-7). Flow through the north inlet would be limited by construction of the 750-foot breakwater. But flow will increase by about three times if the breakwater is shortened and by about four times if the breakwater is reoriented.

TABLE 4-7. ESTIMATED FLOW RELATED TO BREAKWATER CONSTRUCTION SAKONNET HARBOR, RHODE ISLAND

	EBB TIDE	FLOOD TIDE
NO BREAKWATER		
Harbor	69,379 m^3	58,345 m^3
750-FOOT BREAKWATER		
Harbor	72,472	71,147
North Inlet	13,076	15,236
West Inlet	101,371	102,884
	Δ 15,823 m^3	16,501 m^3
SHORTENED BREAKWATER		
Harbor	72,400	6[illegible],400
North Inlet	59,388	60,793
West Inlet	142,903	148,414
	Δ 11,115 m^3	20,221 m^3
REORIENTED BREAKWATER		
Harbor	72,312	65,573
North Inlet	83,792	85,009
West Inlet	190,159	180,783
	Δ 34,055 m^3	30,201 m^3

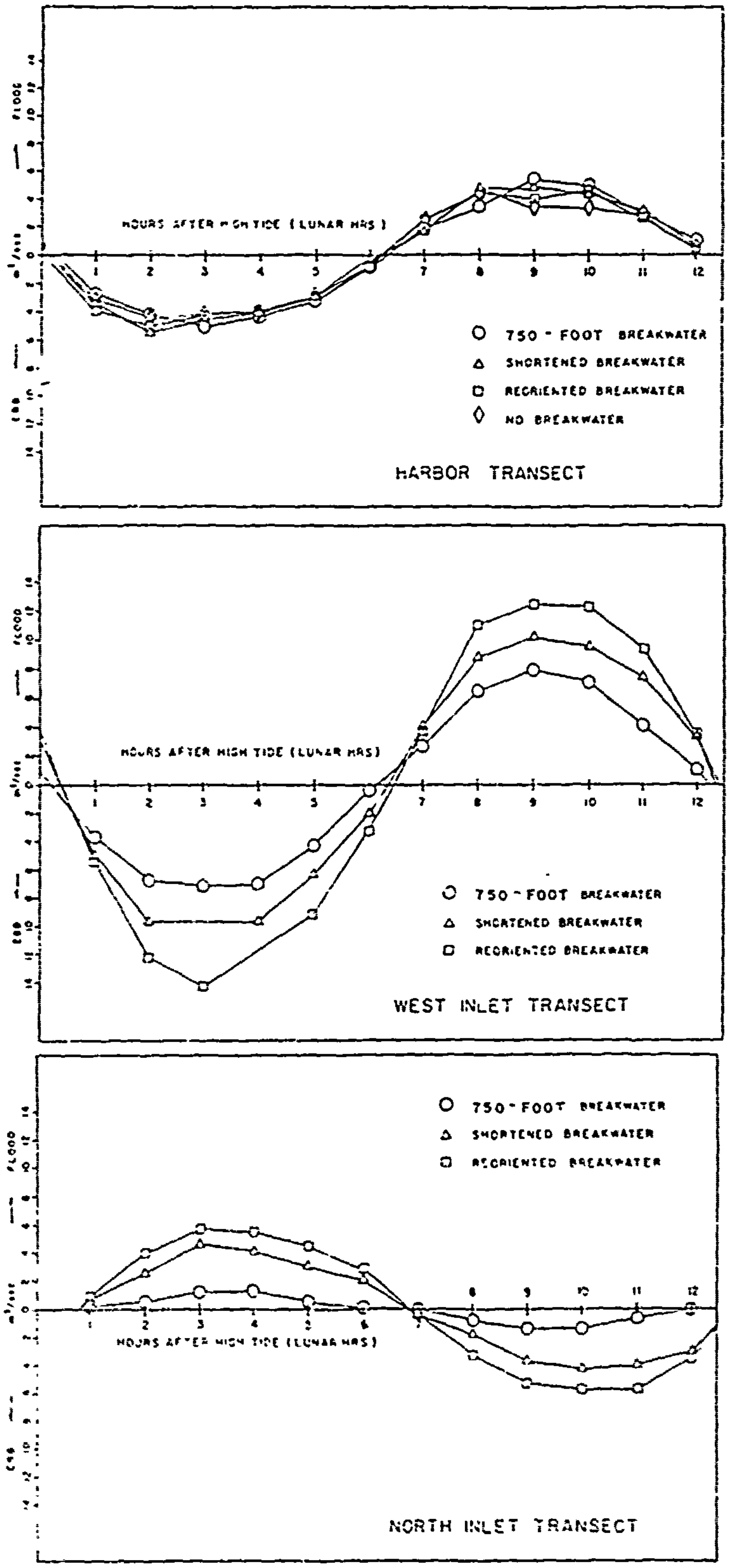


Figure 4-22. Mass flux through three key transects for various breakwater configurations. Sakonnet Harbor, Rhode Island.

There would be about 100,000 m^3 flow through the west inlet with the 750-foot breakwater. The flow would be increased by 50% should the breakwater be shortened. All of the increased flow would move out of the North Inlet (Figure 4-22). Reorienting the breakwater would increase the flow by 85%, as most of the water would move out through the North Inlet.

The mass flux calculations inllustrate the importance of the North Inlet in allowing water to flow along the inside of the proposed breakwater. The cross-sectional area of the North Inlet changes with each breakwater configuration (Figure 4-23). The area for the inlet with the shortened and reoriented breakwater is about three times the area of the inlet with the 750-foot breakwater. It is interesting to note that although the inlets for the shortened and reoriented breakwaters have the same cross-sectional areas, the reoriented breakwater allows a greater volume of water to pass through the inlet.

For steady state flow in one direction, the Navier-Stokes equation (the equation of motion) simplifies to

$$pg \frac{\partial n}{\partial x} = \frac{\partial}{\partial x} (pN_z \frac{\partial u}{\partial z}) \qquad (1)$$

where $pN_z \frac{ou}{oz}$ is a mixing length representation of the vertical Reynolds shear stress. Assuming the density, p, and eddy viscosity coefficient, N_z, to be constant over depth,

$$g \frac{\partial n}{\partial x} = N_z \frac{\partial^2 u}{\partial z^2} \qquad (2)$$

Two boundary conditions must be specified to solve the above equations. Boundary conditions appropriate to the model are:

(1) The surface stress is the wind stress T_s

$$-p \; N_z \frac{ou}{o_z} \Big|_{z=0} = T_s \qquad (3a)$$

(2) The current velocity is zero at the bottom

$$u \Big|_{z=H} = 0 \qquad (3b)$$

Equation (2) is solved by integrating over depth twice and applying the boundary conditions (3).

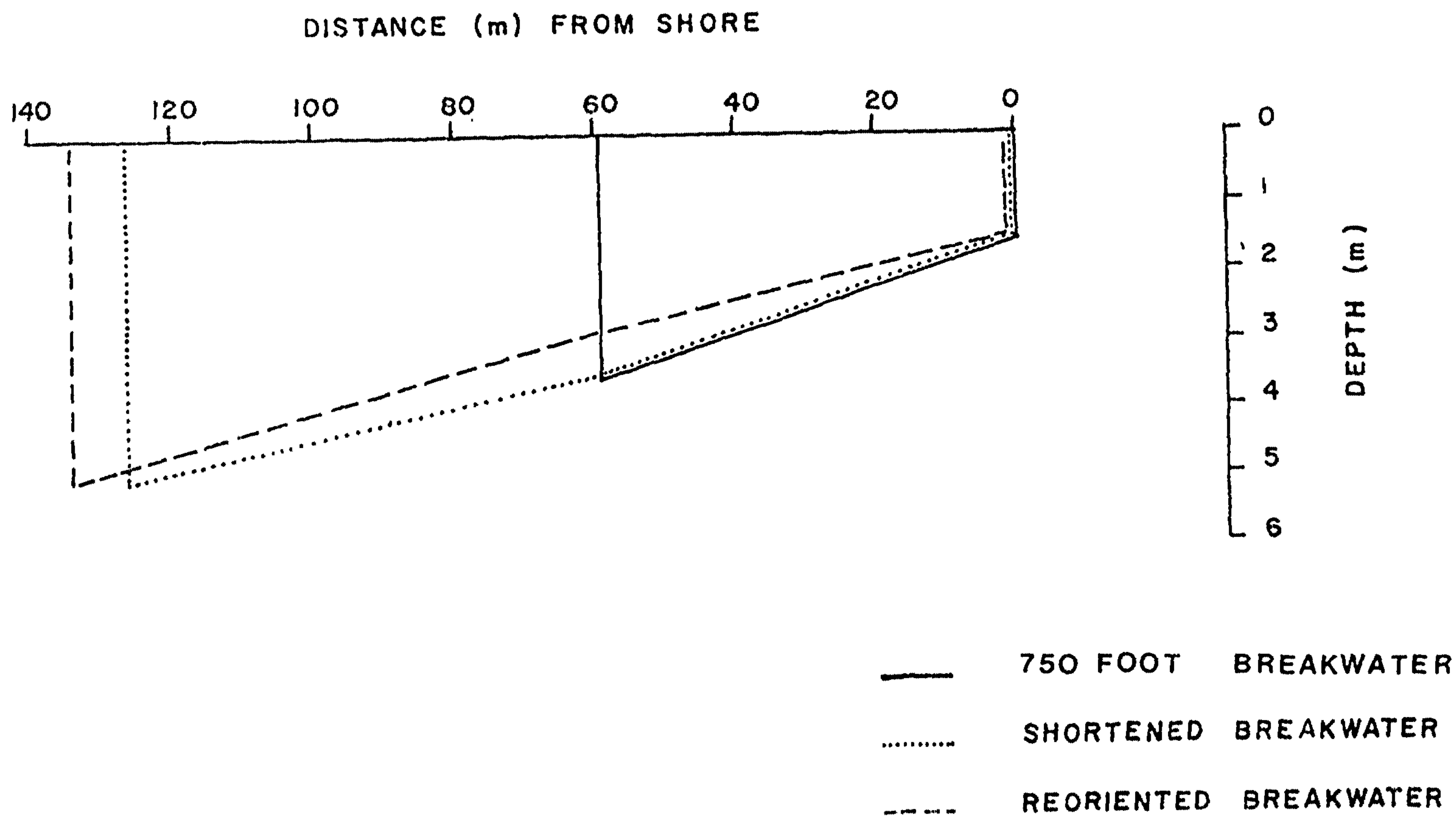


Figure 4-23. Cross section for North Inlet for various breakwater configurations.

$$u = \frac{gH^2}{N_z}\frac{\partial n}{\partial x}\left[\frac{1}{2}\left(1-\frac{z}{H}\right)^2 - \left(1-\frac{z}{H}\right)\right] + \frac{\tau s^H}{pN_z}\left(1-\frac{z}{H}\right) \qquad (4)$$

The solution for u contains a second unknown, the surface slope $\partial n/_{\partial x}$ therefore a second equation must be written. As this is a steady-state model, the net flux through a cross-section of the channel must be zero.

$$\int_0^H u\,dz = 0 \qquad (5)$$

Substituting equation (4) into (5) and integrating yields an expression which is solved for the surface slope to obtain:

$$\frac{\partial n}{\partial x} = \frac{3\tau s}{2pgH} \qquad (6)$$

This expression can now be substituted into equation 4 to obtain the wind-driven current velocity as a function of depth.

$$u = \frac{\tau^s H}{4pN_z}\left(1-\frac{z}{h}\right)\left(1-3\frac{z}{h}\right) \qquad (7)$$

At the surface (z=0) the velocity is:

$$u\Big|_{z=0} = \frac{ts\ h}{4pN_z} \qquad (8)$$

This can be replaced by the three percent rule, which states that the wind-induced surface current is approximately 3% of the wind velocity.

$$u\Big|_{z=0} = 0.03\ V_w \qquad (9)$$

and

$$u = 0.03\ V_w\left(1-\frac{z}{h}\right)\left(1-3\frac{z}{h}\right) \qquad (10)$$

A non-dimensional plot of current velocity as a function of depth is presented in Figure 4-24. It can be seen that water flows in the direction of the wind near the surface, and in the opposite direction near the bottom, which results in a net circulation. The maximum current velocity in the direction of the wind occurs at the surface, and the maximum current velocity in the opposite direction occurs at Z = 2/3H.

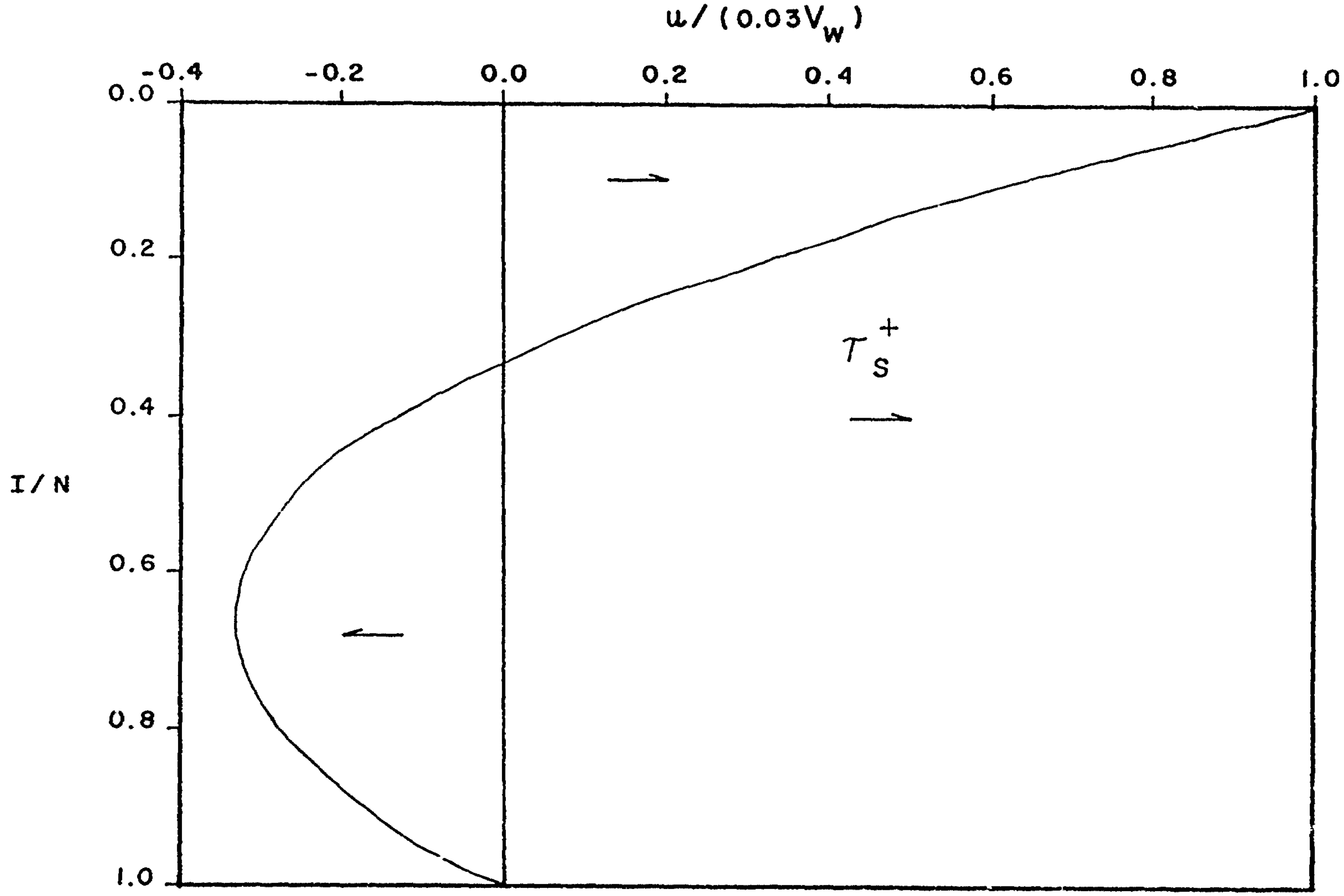


Figure 4-24. Normalized plot of current velocity vs depth, Sakonnet Harbor, Rhode Island.

The mass flux due to this circulation can be evaluated. The depth at which the current velocity changes sign is

$$(1 - 3\frac{z}{H}) = 0 \text{ or } z = \frac{H}{3} \quad (11)$$

The net flux (per unit width of the basin) in this upper layer is

$$q = \int_0^{H/3} u \, dz \quad (12)$$

$$q = \frac{\tau s \; H}{4pN_z} \left(\frac{4H}{27}\right) = 0.03 \; V_w \left(\frac{4H}{27}\right) = 0.004444 \; V_w H \quad (13)$$

For a basin of width W and length L, the total volume of water in the basin is WLH, and the length of time for the wind-driven circulation to flush the basin is

$$T = \frac{WLH}{W_q} = \frac{LH}{q} = \frac{LH}{0.0044 \; V_w H} = \frac{L}{0.0044 \; V_w}$$

Thus the flushing time depends only on the length of the estuary and the wind velocity. Table 4-8 presents maximum wind-generated currents and flushing times for a basin 0.5 nautical mile in length for several wind velocities.

TABLE 4-8. MAXIMUM WIND DRIVEN CURRENTS AND FLUSHING TIMES FOR A BASIN LENGTH OF ONE-HALF NAUTICAL MILE AT VARIOUS WIND SPEEDS. SAKONNET HARBOR, RHODE ISLAND.

WIND SPEED (knots)	WIND SPEED cm/sec	SURFACE CURRENT (knots)	SURFACE CURRENT cm/sec	MAXIMUM RETURN CURRENT (knots)	MAXIMUM RETURN CURRENT cm/sec	FLUSHING TIME (hours)
5	257	0.15	7.7	0.05	2.6	23
10	514	0.3	15.4	0.1	5.1	12
15	772	0.45	23.2	0.15	7.7	8
20	1029	0.6	30.9	0.2	10.3	6

When interpreting these results, it must be remembered that this model is for an idealized situation, where the wind has been blowing steadily for a sufficient length of time to fully devleop the circulation pattern. In addition, the flow is not one-dimensional, but in reality three dimensional, and effects such as tides and basin geometry are ignored. As such, these results should not be taken absolutely but rather interpreted as being indicative of the wind-driven circulation characteristics.

Influence of Wind on Current Patterns in Harbor Under Existing Conditions

Wind is significant in defining the water movement in Sakonnet Harbor. Wind blowing over the water in a semi-enclosed basin, such as Sakonnet Harbor, will cause a circulation pattern. The surface water moves in the direction of the wind stress at a speed typically 3.0% of the wind speed. In confined embayments such as Sakonnet Harbor conservation of mass must be maintained. For example, with wind blowing directly into the harbor, surface water will "pile up" on the inner shore of the harbor. To maintain the increased water level, a constant return flow must be established. This may manifest itself as either bottom or lateral flow against the wind. Conversely, if there is a wind with a component of the wind stress directed out of the harbor, surface waters will be pushed out of the harbor. To maintain a constant depressed water level, near-bottom flow must be into the harbor.

The wind-driven circulation increases the flushing rate over flushing due solely to tidal action. Because this circulation may vary with depth, the types of pollutants influence their flushing rates. For example, if the pollutant floats, i.e. "flotsam and jetsam" or oil, a northwest or southwest wind would cause it to collect in the inner confines of the harbor. If the pollutant is the type which disperses throughout the water column, i.e. fluid discharges, etc., then this pollutant would be flushed from the harbor under all wind conditins. If the wind is directed into the harbor, the pollutant would be flushed out in the near-bottom return flow. If the wind is directed out of the harbor, it will be flushed out in the near-surface flow.

Field data collection at Mooring 2 substantiates the presence of a wind driven circulation (Figure 4-25). The event of interest started on February 4, 1979. The winds over the entire period were generally strong and from the northwest and both the near-bottom current sensors measured flow in a direction opposite the wind stress. The persistent wind stress from the northwest caused the water level along the coast to decrease as the coastal water was blown offshore. During this time, the sensor at Mooring 1, although near bottom, measured flow in the direction of the wind stress. The current sensor in the harbor monitored the expected return circulation. As the northwest wind stress decreased on February 8, 1979, the level of the coastal water returned to more normal conditions, with a short return flow event observed at Mooring 1.

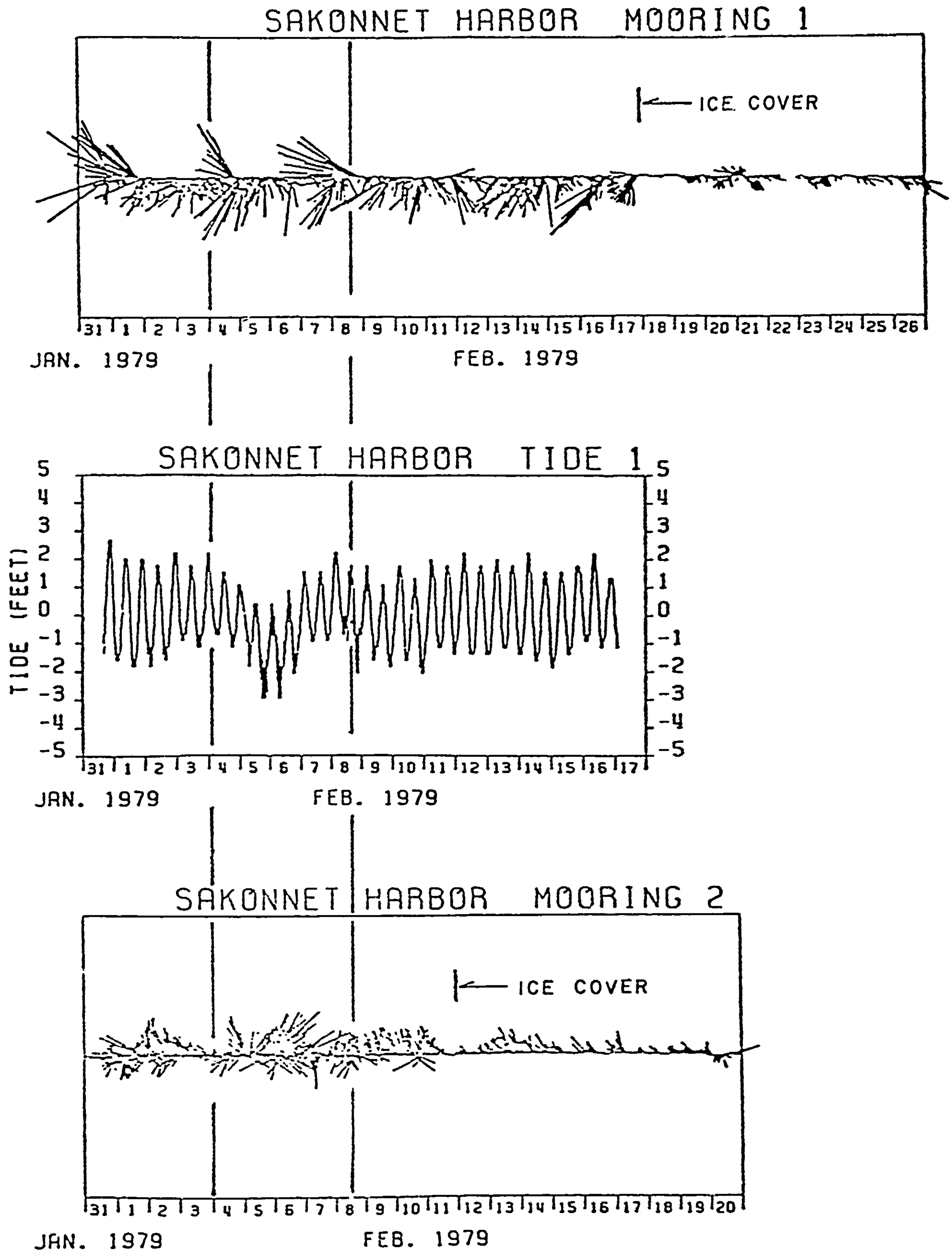


Figure 4-25. Evidence of a wind driven circulation within Sakonnet Harbor, Rhode Island.

A second less dramatic event occurred on February 9 and 10, 1979. At that time, the harbor froze over. The freeze continued with ice cover extending over Mooring 1 on February 17, 1979. With the ice cover, and hence no direct wind stress, currents were dramatically reduced at both mooring sites.

The field observations made in February 1979 illustrate another important mechanism in harbor flushing. At Mooring 1, outside the confines of the harbor, flow was predominantly southward at all stages of the tide. Flow in one direction off a harbor entrance will cause the advection of the ebb tide plume of harbor water to be displaced, possibly away from the area of influence during the subsequent flood tide. This mechanism will cause the entire tidal prism volume to be replaced each tidal cycle. The regional circulation pattern may be caused by a combination of tidal phase changes, persistent wind patterns, and influences of coastal circulation patterns in Block Island Sound.

The various breakwater configurations will influence the wind driven circulation by decreasing the wind wave turbulence which may occur with a northwest wind. Waves can vertically mix pollutants in the water column, but will also tend to inhibt the development of a wind generated two layer circulation pattern.

The wind circulation moves water from the "inner harbor" area to out near the breakwater where it can be entrained in the along-shore movement of water. It is believed that this mechanism is more important in dispersing pollutants than wind wave mixing.

Wind circulation is dependent upon duration rather than fetch. Therefore, the breakwater will probably not significantly influence wind-driven circulation within the harbor. Various breakwater designs will not directly change the wind circulation patterns. Indirectly the greater flux of water past the inside of the breakwater, the more efficient will be the flushing of "inner harbor" water out of the study area.

INFLUENCE OF BREAKWATER ON WAVES

Impact of breakwater construction on wave action is summarized in Table 4-9.

Investigation of wave reflection caused by the 750-foot breakwater indicated that significant wave reflection will not occur. The investigation was limited because knowledge concerning reflection of solitary waves approaching a slope at other than normal incidences is limited (Wiegel, 1964).

A hypothetical case was defined to consider a worst reflection case. The initial conditions for this case were:

(1) Incoming wave orthogonal parallel to the existing breakwater.

TABLE 4-9. SUMMARY OF BREAKWATER CONSTRUCTION ON WAVE ACTION
SAKONNET HARBOR, RHODE ISLAND

CHARACTERISTIC OF BREAKWATER	750-FOOT	SHORTENED	REORIENTED	SPLIT
WAVE REFLECTION				
Storm Waves	No reflection waves will break along breakwater	Same	Same	Same
Small Waves	Possible reflection with reflected wave heights <0.3 incident wave height in north corner	Same	No reflection	No reflection
WAVE REFRACTION	No impact Same	Same	Same	
WAVE DIFFRACTION	Diffracted wave heights equal to or greater will occur in the northern third of the new anchorage area with waves from the southwest quadrant	Same	Same	Same

(2) Wave height of 5.5 ft. in a water depth of 20 ft.

(3) The 750-foot breakwater at a 28^{o} angle of incidence to the incoming wave orthogonal.

(4) The slope of the 750-foot breakwater ≈ 34^{o}.

Because the slope of the breakwater and the low angle of incidence, theory predicts that the wave will break along the breakwater and not reflect into the harbor (Figure 4-26).

A second hypothetical case can be considered. In Figure 4-26, the dividing line is shown between the non-breaking and breaking region for a particular wave height (H) to water depth (d) ratio. By decreasing the wave height (thus decreasing this ratio) wave reflection may occur. Consider a vertical wall; if small amplitude waves reflect, the characteristic of these reflected waves will be as follows:

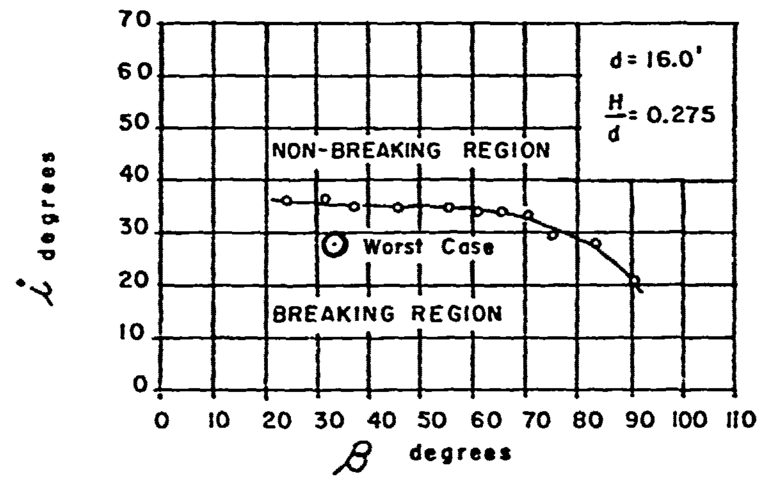
(1) the angle of reflection is equal to the angle of incidence; and

(2) the reflected wave height will be 0.3 the height of the incident wave height when reflected off a vertical wall.

This estimation is a worst case because a sloping wall will decrease the reflected wave height. The portion of the harbor which could potentially be impacted by reflection will be the same area of the new anchorage influenced by wave diffraction.

As a result of wave diffraction the northern portion of the new anchorage will be subjected to waves whose heights will be equal to or as much as 1.2 times the incident wave height when the wave's direction is from the southwest quadrant.

Breakwater construction will not influence the wave refraction patterns in the expanded anchorage, or increase wave heights in that area.



Angle of incidence separating breaking and non-breaking regions (after Chen, 1961)

Figure 4-26. Investigation of wave reflection caused by the 750-foot breakwater after (Wiegel, 1964). Sakonnet Harbor, Rhode Island.

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SAKONNET HARBOR

LITTLE COMPTON, RHODE ISLAND

DETAILED PROJECT REPORT

ECONOMIC AND SOCIAL ANALYSIS

APPENDIX 5

PREPARED BY
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION

ECONOMIC AND SOCIAL ANALYSIS

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ECONOMIC AND SOCIAL ANALYSIS

SECTION A

SAKONNET HARBOR: ECONOMIC ACTIVITY

1. Much of the seasonal economic activity in Little Compton is centered around Sakonnet Harbor, which is presently the home of a small locally-based fishing fleet which operates principally in seasons of fair weather. Several multi-purpose fishing boats and commercial longline fishing vessels operate out of the harbor year-round, but their use from November to March is severely limited. If fishing boats return to the port under adverse conditions, they usually move up the Sakonnet River to more sheltered locations to unload their catch. Marine commerce now located at Sakonnet Harbor includes trap and gill net fishing, lobstering (inshore and offshore), swordfishing, and shellfishing. There are four commercial fishing companies presently at the harbor which provide private dockage for commercial craft. Approximately forty-five commercial fishing vessels list Sakonnet Harbor as their home port, and another sixteen transient commercial vessels regularly called at the anchorage. One hundred eighteen recreational boats use the harbor as home port, and an estimated 760 transient boats spend an average of one day in port each year.

2. Sakonnet Harbor presently provides 140 moorings and 25 slips for private users, and an additional 30 small sailboats are stored on shore for lack of mooring space and safe mooring conditions. This total of about 195 craft is supplemented by about 50 skiffs, rowboats, and small outboard motor boats. There are two launching ramps located at the harbor, and a daily seasonal average of about 15 motor launches and outboards use these ramps. There has been little change since 1969 in the number of transient recreational craft using the harbor

because it is always filled to capacity and there are no new moorings or slips available. Of the private recreational craft in Sakonnet Harbor, there are approximately 56 power and sail vessels over 20 feet in length, ranging in draft from 1.0 to 5.5 feet. These private recreational vessels had a total estimated 1978 value of $524,000. The remaining boats of the recreational fleet are from 12 to 20 feet in length and have drafts between 1.0 and 3.0 feet, and were valued at approximately $128,600 in 1978.

3. Only commercial fishing rivals recreational boating in significance to the area's economy during the summer months. The primary fishery for Sakonnet fishermen is lobster, with thirty-three of the forty-five commercial boats primarily geared for lobstering. The remaining vessels are a mix of power swordfish, trap, seaweed, or charter vessels. Several of the lobster boats are easily rigged for gillnetting and trap fishing when seasonal and cyclical changes in fish population make those forms more profitable. These vessels average approximately 33 feet in length and 3.5 feet in loaded draft. Boats of up to 7-foot draft are able to negotiate the harbor's channel, but only under certain tidal conditions and with a high degree of risk involved.

4. The annual landings exclusive of line and sports fishing were estimated during the 1967-1968 period at about 5,240,000 pounds of fish and 230,000 pounds of lobsters. No official records were kept at that time for Sakonnet Harbor, and these estimates were prepared by local officials. Since that time, records have been maintained by the U.S. Department of Commerce, National Marine Fisheries Service. Catch data for selected years during the period 1971-1978 by major type are shown in Table 5-1.

Table 5-1 REPORTED COMMERCIAL FISH CATCH, SAKONNET HARBOR

1971-1978

Type Catch	pounds	dollars
1972		
Fish	1,223,557	192,862
Lobsters	144,059	180,680
Other Shellfish	163,242	28,599
TOTAL	1,530,858	$402,141
1974		
Fish	1,7[illegible]8,284	228,000
Lobsters	157,303	326,872
Other Shellfish	74,339	13,501
TOTAL	1,999,926	$568,373
1976		
Fish	1,457,776	281,984
Lobsters	261,500	458,300
Other Shellfish		
TOTAL	1,719,276	$740,284
1978		
Fish	1,509,445	478,701
Lobsters	336,636	692,498
Other Shellfish	2,380,360 (1)	192,302
TOTAL	4,206,441	$1,363,501

Source: National Marine Fisheries Service
(1) Shell Stock Weight

5. The quantities landed in Table 5-1 are conservative estimates due to the fact that only about 75% of the actual gross haul is reported by fishermen. In order to obtain more accurate catch figures, the Little Compton Harbor Advisory Board undertook a detailed survey throughout 1976, individually interviewing each boat owner and fishing company. The results of this survey are presented in Table 5-2.

Table 5-2 ESTIMATED CATCH CONFIGURATION, SAKONNET HARBOR

1976

Type of Catch	Weight (lbs.)	Unit Price $/lb.	(Dollars)
Lobster	439,467	$1.94	$850,988
Swordfish	27,000	2.35	63,500
Finfish (incl. eels)	1,378,678	.25	344,586
Crabs	2,686	.63	1,686
Charter			12,000
Seaweed	2,000	.10	200
TOTAL	1,849,831 lbs.		$1,272,960

Source: Sakonnet Harbor Advisory Board

6. The findings of this survey indicate that although the total catch estimated by the Sakonnet Harbor Advisory Baord exceeded that estimated by National Marine Fishery Service (NMFS) by only 130,555 lbs., the commercial value of the advisory board's catch exceeded that of NMFS by $532,676. The main reason for the discrepancy in these two values is the difference in the quantity of lobsters reported, with the advisory board's survey exceeding the preceding estimate by 177,967 lbs. At a unit price of $1.94 per pound, this additional amount of lobster accounts for $345,256 or 65% of the difference in commercial value. A review of the Sakonnet Harbor Advisory Board's survey results by NMFS indicated that the figures presented in Table 5-2 are more accurate than what they themselves publish.

7. As the data in Table 5-1 indicates a substantial decrease in catch has been realized in comparison with the reported catch levels of 1967-1968. This decline was the result of a combination of factors, but was primarily due to the very severe depletion of fish populations by efficient, modernized foreign trawlers equipped with deep water gear. While the volume of total catch has remained relatively stable since 1971, the steadily increasing unit price resulting from an increased demand for high protein foods, increased cost of meat products, and the scarcity of food staples abroad has prevented a decrease in the commercial value of the landed catch.

8. Also contributing to the decline in total landings at Sakonnet Harbor has been the elimination of ocean quahogging from Sakonnet since 1971. During the period from 1969 to 1971, quahog landings averaged about 46,000 bushels or 460,000 pounds of meat per year. The unavailability of these resources at Sakonnet Harbor acquired added significance due to the dramatic increase in demand for ocean quahogs by seafood processors in Rhode Island and other neighboring states. However, the availability of surf clams in waters in close proximity to Sakonnet Point has somewhat offset the economic loss associated with the decline in quahogging. Landings of surf clams totalled over two million pounds (shell stock weight) valued at $188,780 in 1978. Local fishermen have expressed their belief that at the time this supply is exhausted, the quahog resource will be somewhat replenished.

SECTION B

FUTURE CONDITIONS WITHOUT PROJECT

9. Without the implementation of improvements at Sakonnet Harbor to provide protection of the vessels anchored there, little change in the status quo could be expected. The size of the commercial fishing fleet has remained static over the last ten years, due to limits on expansion space and exposure to the elements. There is little doubt that this condition will continue given the present limited facilities and despite the general trends toward improved opportunities in ocean fisheries. Over the long run, it is likely that the condition of the fishing industry in Little Compton will deteriorate due to an inability to compete with more efficient operations out of neighboring ports.

10. The larger, well established fishing ports at Newport and Galilee presently land about 95% of the states total catch, and these ports should continue to dominate future fishing commerce in Rhode Island. However, probable expansion of the fishing industry due to replenishment of the resource under the 200 mile limit on territorial waters should allow small harbors to prosper from increased catches as well. This possibility would be precluded at Sakonnet Harbor if none of the considered improvement schemes were adopted. The harbor will continue to remain almost useless during the period 15 November to 15 February, and the predominant form of fishing will continue to be the floating fish trap method. Fifty years ago, fish traps dominated Rhode Island commercial fisheries in the same manner that trawlers do today.[1] Since 1967, floating traps have accounted for 10% or less of all Rhode Island landings by weight and dollar value. In 1976, however, fully 97% of the finfish landed by Sakonnet fishermen were caught by the floating trap method. Floating fish traps are designed to intercept migrating schools of fish, particularly scup, by setting what is essentially a net trap suspended by floats and anchored to the bottom. This activity is

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[1] Olsen, Stephen B. and Stevenson, David K., Commercial Marine Fish and Fisheries of Rhode Island, University of Rhode Island Marine Technical Report 34, 1975.

limited to a designated season when schools are moving, primarily during the good weather between April and October. During the period 1969-1971, 79% of the states entire floating trap catch was landed in the single month of May. A large portion of this catch was landed at Sakonnet Harbor, located in close proximity to many of the state's designated floating fish trap grounds. This type of fishing is conducive to present conditions at Sakonnet because it can be accomplished in small to medium-sized open boats in the 30-to-35 foot length range, which can easily navigate the harbors limited area.

11. Because conditions at Sakonnet Harbor presently discourage the modernization of the fishing fleet to include the more efficient and productive trawlers capable of gillnetting and longlining on a year-round basis, landings at that port cannot be expected to increase significantly in the absence of physical improvements. Only the twelve boats currently anchored at Sakonnet with the capability of operating on a year-round basis would be expected to continue doing so in the future. Similarly, lobstering would continue on a scale approximately equivalent to that which exists today. The trend toward offshore lobstering would continue, with Sakonnet's lobstermen either operating out of alternative ports during winter months or hauling their vessel ashore until spring.

SECTION C

ALTERNATIVES AND THEIR ECONOMIC IMPACTS

12. The study process for the future development of Sakonnet Harbor has resulted in the selection of three distinct plans of improvement, designated Plans A, B, and C, for more detailed analysis. In addition, a "no-action" plan must be considered in the planning of all Federal projects, with all economic benefits attributable to all other plans of improvement shown to be in excess of economic condition which would result from no action. In the case of Sakonnet Harbor, the lack of Federal action would result in the implementation of no physical improvements at the port and would reflect those conditions described as "Without Project Conditions" in the immediately preceding section. Expansion of the commercial fishing industry would be unlikely through either the addition of new vessels, upgrading the existing fleet, or extension of the fishing season. In general, discussion with local fishermen indicated that their operations at Sakonnet Harbor would remain similar to the status quo.

13. The first major alternative, identified as "Plan A," would provide a 750 foot rubble mound breakwater with faces of armor stone across the open northerly approach for the purpose of providing winter protection. A 110-foot wide channel along the existing west harbor breakwater would also be delineated. This channel would be dredged to a depth of ten feet mean low water to allow the safe passage of large multipurpose fishing vessels under all tidal conditions.

14. The second alternative, Plan B, includes all elements of Plan A, but with a breakwater reduced in length to 500 feet.

15. Plan C, the final alternative for consideration, differs from Plans A and B in two respects only. The proposed breakwater is 600 feet in length and oriented in a more southerly direction.

16. Estimated construction costs for each of the aforementioned plans are shown in Table 5-3. Detailed cost estimating procedures are displayed throughout Appendix 4, entitled Engineering Investigation, Design and Cost Estimates.

Table 5-3 Estimated Construction Costs
(1 June 1980 Price Levels)

Project Feature	Estimated Cost
Plan A	
Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,790,000
Contingencies (15%)	268,500
Total Construction Cost	$2,482,700
Engineering and Design	123,500
Supervision and Administration	164,700
Total Estimated First Cost	$2,346,700
Plan B	
Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,277,000
Contingencies (15%)	192,000
Total Construction Cost	$1,469,000
Engineering and Design	85,000
Supervision and Administration	110,000
Total Estimated First Cost	$1,800,000
Plan C	
Channel:	
Dredging	$121,000
Contingencies (12%)	15,000
Total Dredging Costs	$136,000
Breakwater:	
Materials and Construction	$1,510,000
Contingencies (15%)	226,500
Total Construction Cost	$1,736,500
Engineering and Design	104,200
Supervision and Administration	138,900
Total Estimated First Cost	$2,115,600

Annual costs for each of these alternative plans was calculated at an interest rate of 7-3/8% over a project life of 50 years, as presented in Table 5-4.

Table 5-4 Estimated Annual Costs of Proposed Plans

	Plan A	Plan B	Plan C
Interest and Amortization	$188,500	$136,600	$160,600
Annual Maintenance			
Breakwater	20,000	15,000	17,000
Channel	2,400	2,400	2,400
Total Annual Maintenance	22,400	17,400	19,400
Total Annual Cost	$210,900	$154,000	$180,000

17. Each of these plans would offer some degree of protection from winter storms, and each would allow navigation of the channel by even the largest vessels of the Sakonnet fleet under almost all tidal conditions. The same general categories of economic benefits could reasonably be expected to accrue to all plans, including: Net Income Benefits through increased number of winter vessels, increased number of fishing days for the existing winter fleet, and longer fishing days; savings in transportation costs, both through decreased steaming time and decreased trucking; and reduction of damages to vessels moored in the harbor.

18. The most significant benefit anticipated as a result of all three action plans is increased net income to fishermen. Discussions with local fishermen reveal that of the approximately forty-five commercial fishermen at Sakonnet, only about twelve remain active in the harbor during the winter months. Approximately one-half of the remaining thirty-three vessels currently transfer their operations to alternative ports from mid-December to mid-March, while the other half of the fleet merely hauls its vessels ashore to remain idle for three months. Of this group which becomes idle, several fishermen have indicated a desire to operate on a twelve month basis if harbor conditions were improved. The addition of a protective breakwater would serve as an incentive for the upgrading and modernization of these vessels because it would allow fishermen to amortize their investment over a full year fishing season rather than nine active months per year. Eventually, it is anticipated that investments in new larger vessels, some as replacements for existing vessels and others in addition to the existing fleet, would result.

19. Engineering investigations have been conducted to determine what breakwater length would be sufficient to provide adequate wind and wave protection to generate net income benefits. An assessment of fishermen's needs for reduced wave action developed through discussions with several local officials and fishermen indicated that wave heights in excess of two feet would be sufficient to curtail fishing activity in the harbor. With two foot wave heights it appears that larger vessels would suffer some inconvenience, while average to smaller sized vessels would suffer significant inconvenience but still remains able to navigate to and from

open water and unload. The breakwater provided by Plan A would effectively reduce wave action in Sakonnet Harbor to one foot, Plan B to 1-1/2 feet, and Plan C, with a different orientation , also to 1-1/2 feet throughout most of the harbor, but would leave a segment of the harbor, including portions of the channel and unloading areas, unprotected and subject to wave heights of 2.2 feet. Thus, while Plan A would afford the highest level of protection, Plan B would be adequate to prevent loss of fishing days due to excessive wave action in the Harbor under all weather conditions. Plan C would provide adequate protection to allow on expanded winter fleet to operate out Sakonnet, but would provide fewer additional fishing days than Plans A and B, not because of its length but because its orientation would expose a larger part of the harbor. Any breakwater of significantly shorter length than 500 feet would be expected to allow too much turbulence in the Harbor to prevent lost fishing days due to wave action under all weather conditons.

20. It is apparent that differences in the levels of protection offered by Plans A and B would result in no significant difference in net income benefits that would accrue to fishermen subsequent to their implementation. Plan C would render a smaller net income benefit because it would offer less protection due to its orientation. All three improvement plans would provide the incentive necessary for an increased winter fleet size. Of the approximately fifteen vessels hauled ashore during the winter months, it was estimated by local fishermen that ten vessels could be expected to fish year-round after completion of a breakwater. Plans A and B would differ from Plan C in the number of additional fishing days allowed as a result of the level of protection offerred. For Plans A and B it is estimated that the ten new vessels added to the winter fleet would average three trips per week over the twelve week extended season, for a total of thrity-six additional trips in the winter months. Plan C would be expected to allow at least two additional weekly trips for the same ten vessels over the same twelve week period. These vessels, after implementation of any one of the three plans, would engage primarily in gillnetting for finfish because the December to March period is not included in either the trap fishing or lobstering seasons. Fishermen claim that a good catch of finfish for a single large vessel trip often reaches 5,000 pounds, with an average per pound value of \$.35. A more conservative per trip catch of 2000 pounds, considering the range in size of the ten vessels expected, would result in the following increased gross landings:

Plan A and B:	10 vessels x 36 trips x 2000 lbs. x \$.35 = \$252,000
Plan C:	10 vessels x 24 trips x 2000 lbs. x \$.35 = \$168,000

21. Those twelve vessels already operating out of Sakonnet Harbor on a year-round basis would also benefit from additional protection through an increased number of fishing days. Information gathered from local fisherment indicated additional trips would be gained over the three month winter period. It is estimated that Plans A and B would allow 4 additional days for each vessel per month and Plan C 2 days per month.

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Plan A and B:	12 vessels x 12 trips x 2000 lbs. x $.35 = $100,800
Plan C:	12 vessels x 6 trips x 2000 lbs. x $.35 = $50,400

23. The total increase in value of landings resulting from implementation of Plans A, B and Plan C would therefore total $352,800 and $218,400, respectively. The net income concept dictates that benefits are allowable only for that portion of increased landings exclusive of operating costs. The cost of operation is generally assumed to be approximately 33% of the gross haul, but in the case of Sakonnet Harbor is estimated at 40% to reflect the cost that may be incurred by several of the vessels to gear up for gillnetting. Thus, the net income benefit resulting from increased vessel trips during the regular fishing season and during the additional active winter months anticipated would total $211,700 for Plans A and B, and $131,000 for Plan C.

24. Additional net income benefits attributable to the increased channel depth would be expected to accrue to each of the proposed plans. These benefits would be realized year round by the existing fleet through an increase in lobster landings, resulting from the longer trips and larger, better equipped vessels. Under present conditions, lobstermen are often forced to leave grounds earlier than they ordinarily would to reach Sakonnet Harbor at high tide, even though the total catch could increase substantially with just a few hours of additional time working. Another frequent problem encountered during tidal delays that occur when the harbor is not reached at high tide is the death of lobsters from trauma resulting from confinement in overcrowded on-board tanks for an excessive time period. These factors combined, plus the overall trend toward larger, better equipped vessels, could reasonably be expected to result in an annual 5% increase in lobster landed, or an additional 16,830 pounds valued at approximately $35,400. Deducting 40% for operating expenses, the net increase in income to fishermen would total $21,200, and would accrue equally to each of the three plans because they all would provide the same channel.

25. Total increased net income to fishermen, shown in Table 9, is estimated at $232,900 for Plan A and Plan B, and $152,200 for Plan C.

26. A second category of benefits anticipated from the implementation of Plans A, B or C is savings in transportation costs. The basic benefit accruing to all plans would stem from the elimination of the need for an estimated fifteen vessels to transfer winter operations from Sakonnet to alternative ports, primarily Tiverton. Fishermen claim that the additional steaming time required daily in reaching fishing grounds from this port and making the return trip is about an hour, consuming an average of 15 gallons of diesel fuel per hour, at $1.00 per gallon. For the 15 vessels that normally relocate to Tiverton over 36 additional fishing days provided by Plans A and B the increased cost of operating on water out of the port of Tiverton totals $8,100. For Plan C, cost savings in transportation at sea would total $5,400 for 24 days of winter fishing. Additional cost savings would also accrue to several fishermen who reside in Little Compton through the elimination of the 20-mile round trip by pick-up truck to reach Tiverton on each fishing day.

27. Transportation savings would accrue to all three action plans as a result of the elimination of tidal delays and the additional fuel consumed during those delays. This benefit would be realized by a small number of boats due to the fact that only the larger, deeper draft members of the fleet experience frequent delays. Information gathered through discussion with fishermen indicates that the five largest fishing vessels in the harbor experience an approximate total of 4 hours additional idling time per month, 12 months per year, consuming approximately 15 gallons of diesel per hour at $1.00 per gallon. The total additional cost of fuel which could be saved as a direct result of the channel deepening provided by all three plans is valued at $3,600. Thus, transportation savings for Plans A and B total $11,700 and for Plan C, $9,000.

28. It should be noted that channel dimensions of 110 feet wide and 10 feet deep were selected for all three plans because they were considered optimal in terms of allowing the maximum net reutrn on the investment. Benefits which could be expected to accrue to a 10 foot channel at Sakonnet Harbor have been detailed, including $21,200 in Increased Net Income to Fishermen and $3,600 in Transportation Savings, for a total benefit of $24,800.

29. Discussion with fishermen clearly indicates that inadequate channel depth is a serious problem at the present time. Not only does it cause lengthy tidal delays in some cases, but problems also result when the larger loaded vessels approach the Harbor at all levels of the tide and churn up bottom sediments during passage. Engine pumps continuously draw seawater with high sand content, causing increased maintenance costs and sometimes mechanical failure. Fishermen prefer, when possible, to wait for adequate tidal conditions to allow passage into the Harbor without

disturbing bottom sediments. Fishermen have indicated that adepth of 10 feet, MLW, would be necessary to allow operation completely free of tidal restrictions.

30. The largest vessels at Sakonnet at the present time draw approximately 8 feet of water loaded. It is anticipated that the trend toward this size vessel will continue over the short run at Sakonnet, and over the course of the project life the probability exists that even larger, deeper draft vessels will fish out of Sakonnet. Other ports in the general region currently report vessels up to 100 feet in length with drafts up to 12 feet including New Bedford, Masschusetts, and Point Judith, Rhode Island. Boat manufacturers also claim that vessels in these larger categories will become more prevalent over the near future, an opinion based on present orders being received for construction. These larger boats are considered preferable because they allow greater versatility in both method and location of fishing chosen.

31. As previously stated, the five largest vessels at Sakonnet are currently subject to tidal delays. If the channel were dredged to acheive a uniform depth of 8 feet only, there would be little change from the present condition. The larger vessels, drawing approximately 8 feet completely loaded, would require the full 10 foot depth to pass safely under all conditions, including very low tides and under rough sea conditions. Because fishermen would be subject to almost the same tidal restrictions with an 8 foot channel as they currently are, very little benefit would be gained. Additional fishing time allowed would not be as great, nor would the savings due to the elimination of lost lobster catch now caused by tidal delays be as great. If it is assumed that an 8 foot channel would allow an annual increase in lobster landed of 3%, an additional 10,100 pounds valued at $21,210, the resulting net income benefit after deducting operating costs of 40% would total $12,700.

32. An additional savings in transporation costs would not result from a uniform 8 foot channel elimination of the four hours per month of idling time that fishermen currently claim while waiting for adequate water depth would not occur.

33. The total benefit attributable to a channel with a uniform depth of eight feet due to Increased Net Income to Fishermen and Transportation Savings would be $12,700. Since the depth of water existing in the harbor is now 8 feet mean low water, no construction would be required. However as Table 5-5 indicates the 10 foot channel would provide for an additional $1,800 in net benefits. The annual cost associated with the 8-foot depth is based on the assumption that it will require periodic maintenance to assure the proper depth of 8 feet MLW.

34. It is not anticipated that a channel depth of 12 feet at Sakonnet Harbor would provide any benefits in addition to the $24,810 that would accrue to ten foot ch^nnel because ten feet would be adequate to accomodate all vessels at fi hing out of that Harbor under almost all tidal conditions. Table 5-5 below summarizes the relationship between annual costs and benefits for an optimal channel depths at Sakonnet Harbor.

Table 5-5 Optimization of Channel Depth at Sakonnet Harbor

	8 Ft. Depth	10 Ft. Depth
First Cost	0	$136,000
Total Annual Cost	$2,400	$12,700
Annual Benefit	$12,700	$24,800
Net Benefit	$10,300	$12,100

Since a ten foot channel depth maximizes benefits net of costs, it has been selected at the appropriate depth to be incorporated into Plans A, B, and C.

35. A similar analysis of alternative channel widths resulted in the decision that 110 feet would provide optimal conditions in Sakonnet Harbor. Two-way traffic capability would be a necessity because construction of a breakwater would force many recreational vessels to utilize the channel to enter and exit the harbor. Although economic benefits would accrue even in one-way traffic because the time required for channel passage is minimal, a 110 foot channel was considered necessary for safe navigation.

36. A final measurable benefit anticipated as a result of the improvement of Sakonnet Harbor is the reduction of boat damages. Information obtained from the Little Compton Harbor Advisory Board, compiled by polling commercial fishermen at Sakonnet Harbor indicates that damage reduction to permanent and transient vessels would total approximately $4,500.

37. The benefits discussed which would be expected to accrue to each of the proposed improvement plans are summarized in the following table along with the corresponding Benefit-Cost ratios.

Table 5-6 Annual Benefits

	Plan A	Plan B	Plan C
Increased Net Income to Fishermen	$232,900	$232,900	$152,200
Transportation Savings	11,700	11,700	9,000
Reduction In Damages	4,500	4,500	4,500
Total	$249,100	$249,100	$165,700
Benefit-Cost Ratios	1.2	1.6	1.0
Excess Net Benefits	$16,200	$95,100	---

38. As indicated by the Benefit-Cost ratios shown, all proposals are economically justifiable on the basis of at least a one dollar return for each dollar invested. The selected plan for National Economic Development, identified as that plan for which benefits net of costs are maximal, is Plan B. It should also be noted that total construction costs for Plans A and C exceed the $2,000,000 maximum cost level for Federal participation in a project planned and constructed under the Section 107 authority.

SECTION D

SOCIAL IMPACTS

39. At the present, it appears that negative socio-economic impacts resulting from the implementation of any of the proposed plans would be minimal. Major concerns expressed by both seasonal and year-round residents involve a fear of increased highway traffic, increased rowdyism in the harbor area, a negative effect on property values, and a questionable effect on taxes.

40. Because the project's intent is primarily to intensify the utilization of the harbor during the inactive winter months, when recreational craft are hauled onshore and summer residents are away from Little Compton, increased traffic on land and on the water should not be a significant problem. Since growth of the fleet is not anticipated and total catch during the summer months is expected to increase by only small amounts as a result of project implementation, the existing road system in the area should not be subjected to any significant additional utilization. During the winter months, traffic levels on the local roadway should remain far below the current peak seasonal use.

41. Concern over potential rowdyism at Sakonnet Point based on past problems in the area appear somewhat unrelated to more intensive year round utilization of the harbor. Local law enforcement officials do not feel that Sakonnet fishermen have, as a group, contributed to past incidents of rowdyism, but rather have attempted to downplay such behavior. The belief has also been expressed locally that an increase in wintertime employment may help to eliminate public disturbances. The probability of additional employment opportunities during the winter months is particularly significant to the town of Little Compton, where the unemployment rate often peaks at 13% during winter.

42. The expected upgrading of the fishing fleet at Sakonnet Harbor should not have a detrimental effect on property values in Little Compton. Maintaining an efficient modern fleet of approximately the same size as that which currently exists should have only beneficial

effects on commercial property values in the immediate harbor vicinity, and therefore on the future tax base. Since fishing related activity at Sakonnet Point is isolated from most of the residential area of the town, values of residential properties should be protected from decline. The strong zoning regulations which currently exist in Little Compton should be sufficient to prevent any encroachment of commercial activity related to the fishing industry on residential areas.